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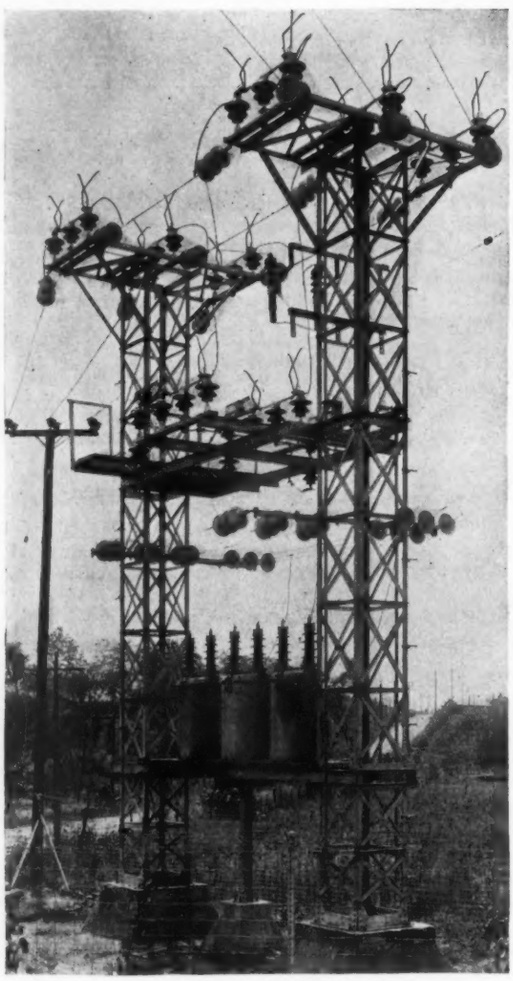

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 91 — *New York, Saturday, March 3, 1928* — NUMBER 9

Forestalling Criticism

THOSE holding companies whose skirts are clean with regard to the factors which the Federal Trade Commission has been authorized to investigate owe it to themselves and to the industry to make the facts known. If there are others whose record is less creditable, it is to be hoped that the investigation may disclose all of the facts—that such cases may be isolated by the commission, lest the industry as a whole be charged with the shortcomings of the few. In the case of the former, voluntary submission of the data on the subjects of inquiry, through financial statements, the press or other media, will aid the commiss in its work and will forestall inconvenience to the companies. It is easier to avoid criticism than to eliminate its consequences.

To illustrate what is meant, one of the holding companies, the Engineers' Public Service Company, intentionally or otherwise, points out in its report that "earnings are derived solely from interest and dividends on securities owned and from incidental interest on the surplus funds." Evidently there are no exorbitant engineering and management fees. Disposing of the possible charge of "pyramiding," the report presents a tabular statement showing that the parent company owns nearly 100 per cent of the common stock of all of its subsidiaries. Furthermore, the purpose behind the formation of this holding company, and the value to the security holders of the system as a whole, are carefully discussed. Similar instances could be presented from the financial statements of other companies.

These are only a few of the points that will be investigated. There are others that could be cleared up in advance by a frank statement.

* * * *

Economic Triumph of the Steam-Electric Station

ALTHOUGH the electric light and power industry realizes in a general way the increasing efficiency that attends its operations, few know intimately the exact measure of that efficiency. The Department of the Interior, however, through the Geological Survey, has for years gathered statistics on the production of electricity and the consumption of fuel by public utility plants, and it is from this government source, in a report dealing with the production of electricity in public utility stations, that the following commendation emanates:

"The improvement in the average utilization of fuels that has been brought about by improvements in plant designs and operation during the last few years continued in 1927. The operators of public utility power plants performed the remarkable feat of generating about two and one-half billion more kilowatt-hours of electricity by the use of fuel in 1927 than in 1926 by the consumption of about 150,000 tons of fuel less than was used in 1926."

Now, this is not an exceptional case. The industry has shown continuous improvement in the use of coal for years. In 1921 it consumed 31,585,000 short tons of coal and produced 26,000,000,000 kilowatt-hours. Last year it produced 50,000,000,000 kilowatt-hours of electrical energy from 41,713,000 short tons of coal. Some of the energy was produced from oil and gas, but the ratio holds. It is significant that in 1919, when 24,000,000,000 kilowatt-hours was generated from fuel, 35,000,000 short tons of coal, 11,000,000 barrels of oil and 21,000,000,000 cubic feet of gas were consumed, whereas in 1927, with more than double the output of electrical energy, 41,000,000 tons of coal, 6,000,000 barrels of oil and 63,000,000,000 cubic feet of gas were employed. That is 6,000,000 tons of coal more, 5,000,000 barrels of oil less and 42,000,000,000 additional cubic feet of gas.

This is a fine tribute to the engineering excellence of public utility enterprises. It indicates why rates are being reduced and reveals also why steam-station production is increasing at a faster rate than hydro production and why interest in water-power development is not so great as it was. Of course, increased efficiency is not always attainable without additional cost, but that is another story. The tale as it stands suffices to show what a conserver of natural resources the electrical industry is, and when translated into social service the accomplishment is almost unbelievable. Yet the facts cannot be denied.

* * * *

Electrical Engineers and the Span of Life

BEFORE 1928 was six weeks old the American electrical fraternity was called upon to mourn the passing of two of its distinguished engineers—Elmer E. F. Creighton of the General Electric Company and William C. L. Eglin of the Philadelphia Electric Company. Mr. Creighton was 55. Mr. Eglin was 57. Their failure to attain the 70 years that by scriptural prescription every mortal thinks of as the lowest limit of his sojourn on earth suggests a comparison of their ages with those of other widely known American electrical engineers who have died so recently that their memories are still green.

A reference to the longer obituary articles in the ELECTRICAL WORLD'S files for 1923-1927 shows ten written to commemorate either engineers or company executives with a broad engineering background. Of these the only man coming within hailing point of 70 was John A. Britton, who died at 68. Carl Hering was 66, Henry M. Byllesby 65 and Schuyler S. Wheeler 63. Benjamin G. Lamme reached three score. Of the others Charles P. Steinmetz and Louis Bell were 58, Ernest F. Nichols 55, John L. Harper 51 and Milan R. Bump 44. The twelve men occupied divergent fields. Britton, Byllesby and Wheeler were respectively heads of an operating, a holding and a manufacturing company; Hering and Bell were consulting engineers;

Lamme, Steinmetz and Creighton were in the employ of great manufacturing companies; Nichols was a physicist, for most of his life a technician and educator rather than a practitioner; Eglin and Harper were chief engineers of power companies, and Bump was a holding-company engineer-executive. But they were alike in that they all died too soon—their careers cut short in the full tide of achievement and probably before thought of retirement had entered the mind of any one of them.

Is there not something a little disquieting in their comparatively short lives, averaging 58 years? A more inclusive list of eminent members of the fraternity recently departed, taking in men like Joseph B. McCall, 56, and Guy E. Tripp, 62, would probably raise the average very little, if at all—though it is true that Charles R. Huntley reached 73 and Charles A. Coffin 81. Does this lack of longevity point the old moral of overwork and neglect of health and, therefore, fall in the category of preventable—though, alas! too seldom prevented—disasters? Or is electrical engineering one of those callings where to win great success all save a few must reconcile themselves to shortened life? Fortunately for the dissipation of gloomy thoughts, there are still living among us men high up in this profession who have passed three score and ten and a few of whom tread hard on the heels of the youthful veteran of Menlo Park, now headed for 90.

* * * *

Executive Indifference a Barrier to Selling

IN SO FAR as the power industry is concerned, the biggest immediate problem in market development is not what can be done with the public, but what can be done with the executive. How can he be interested in commercial policy? How can he be brought into intimate touch with sales problems and sales plans?

No matter what we think, the public is not vitally interested in things electrical at this moment. The ordinary family feels that it must have electric light. It is standard for the modern home. The other uses of electricity are looked upon as appealing but not essential. Otherwise ten million wired homes would not be today without vacuum cleaners, for example, while seven million have them—to approximate the figure. Otherwise more than 3 per cent of wired homes would use electric ranges. But all that can be corrected by selling. For the same commercial enterprise that has popularized the phonograph, the radio, the camera and the automobile will popularize electrical appliances in the same homes. The kind of selling that has put over the good roads idea will put over good street lighting. The kind of marketing that has established the cash register and the time clock in universal use will build a universal market for electrical equipment in the store and in the factory.

When it comes to selling to the executives of the power industry themselves the idea that market building must be organized today on this broad scale and bulwarked with real leadership and financing, the task is harder. For these executives almost to a man are thinking as engineers, as operators, as financiers. They are not interested in commercial policy. They feel no enthusiasm for selling. They see the romance in a turbine, but not in a merchandising campaign, a load-building program. And that, to a very large extent, is what's the matter with the commercial end of the power industry. If the building of the market were receiving the high executive support —the planning, the direction and the leadership—that goes into the building of the transmission system and the development of the financial structure, the electrical industry would have as proud a record for its selling as for its technical achievements. And, after all, it is through selling that the true public service comes, for it is selling that introduces the uses of electricity into the lives and the work of the people.

* * * *

Price Courage as a Responsibility

PRICE cutting is under very active discussion at the moment. There are two viewpoints. The purchasing agent is charged with taking unfair advantage of the manufacturer in this buyers' market and doing injury to the industry by beating down price levels and demoralizing values. The manufacturer is criticised for voluntary and precipitate price cutting impelled by eagerness for orders. Not all purchasing agents are indicated, of course, and not all manufacturers. But there is evidence enough to make the picture a distressing one, despite a vigorous defense by the buyer, that this is just the good old battle between the forces of supply and demand.

It is interesting to note, however, that there is one feature of the argument in which both sides are in accord. Manufacturers as well as purchasers agree that the power of "yes or no" lies in the hands of the seller. His ability to use it depends upon his courage. And there is no substitute for courage. But price courage is largely a matter of organization. For the most courageous salesman is apt to be the one who has the most courageous boss. And the company with the strongest price policy is usually headed by an executive who in a pinching market would rather sacrifice volume and loss in idle capacity than cut prices and compromise the principle that goods should not be sold at a loss. It is easy to talk about price courage. It is hard to battle in the marketplace. But price cutting is contagious. It is infectious. The manufacturer cannot escape his responsibility both to protect himself and to defend the economic soundness of values. There cannot be too much discussion on this point.

* * * *

Interpret the Facts

UNDER stress of acute competition for industrial heating business, power sales engineers sometimes hesitate to make public the kilowatt-hour requirements of particular processes per unit of product, fearing that the data will be seized upon by representatives of gas or oil-burning apparatus and used against electricity in economic comparisons. On a B.t.u. basis electricity may not in certain cases show economies over combustible fuels, but its advantages in other ways may suffice to win the decision from the intelligent purchaser. The only safe way to meet this condition is to bring out the facts and to evaluate them as applied to each case in hand. Gas or oil may hold the trump cards in one case, electricity in another, and an all-around analysis of the costs and benefits of the different competitive methods is essential to a sound determination of what to use. An open-minded purchaser will allow certain points in favor of the quality repetition, improved working conditions, accurate control and flexibility of electric heating if the sales engineer knows how to present these claims. Many times the scales have turned toward electricity in negotiations where a bare fuel comparison showed lower outlays for other agencies, because of these real, if at times intangible, advantages. Excessive caution defeats its own ends in this field as in many others.

Insulation at a Price

SERVICE standards are very high in the electrical industry, and often the cost of maintaining these high standards is enormous. The whole problem of system insulation is now largely a matter of fixing standards of service in terms of the cost of insulation. Much talk about ground wires, arcing rings, protection of terminal apparatus and other elements of utility systems deals with the necessity of spending money for insulation.

On transmission lines agreement is now had that ground wires are splendid assets to service continuity if properly installed and if low-resistance grounds are permanent along the lines. But they cost money. Whether to use arcing rings or a larger number of insulator units is also largely a matter of dollars. For example, a string of fifteen suspension units with arcing rings is about equivalent to eighteen suspension units without arcing rings under impact tests. To determine which to use involves a balance of the first costs of insulators, arcing rings and relays and an evaluation of the fact that possibly more insulators must be replaced and more maintenance will be required if no arcing rings are used. The relative erecting costs must also be considered. No general statement should be made and no experience on any one system can be taken as proof that the same experience will be had in other localities. After the balance sheet is made judgment based on local conditions and service standards must award the decision.

Then, again, if a line is made immune from flashover, it becomes necessary to protect the terminal station equipments. Added equipment insulation, caging of lines for some distance from the station, use of fused horn gaps, graded line insulation, arresters, special relay installations and many other methods may be used individually or in combination. What to do is largely a matter of service standards and costs to obtain these standards.

* * * *

Improvements in Turbo-Generators and Speculations Upon Them

SUCH a record of improvements as that presented by S. L. Henderson and C. R. Soderberg at the winter convention of the A.I.E.E. indicates that designers and manufacturers of turbo-generators at least are giving sympathetic consideration to the major requirements of users and seem to have the solution of problems well in hand despite the rapid increases in rating demanded. Ventilation no longer appears to be a limitation, and hydrogen cooling may become an actuality if the units now designed therefor are so operated. Coil insulation is being so made and protected against corona that coils designed for 22,000-volt operation have withstood momentary tests of 160,000 volts. Objections to the use of silicon-steel laminations have been circumvented so that core losses have been reduced considerably. Short-circuit ratios are being held to values that avoid instability of operation. Use of structural-steel frameworks is simplifying the shipping of large units, but the weight of rotors is still a limiting factor.

If the attention being given to centrifugal, bending, longitudinal and torque stresses in the turbo-units under operating conditions is any indication of the study being devoted to vibration problems in turbine blades, it may be hoped that even these elements will give very infrequent trouble. Studies of resonance frequencies indicate that there may be more than one critical speed, that flexibility of bearings has an influence, and that the problem is now to design units so that under normal variations their speed will remain within the valleys of resonance curves.

Speculation regarding some problems suggests possible value in the investigation of such subjects as: (1) the feasibility of annealed vitreous coil insulation; (2) semi-conducting slot liners that can be maintained in close contact with the insulation to prevent corona; (3) circulation of water, oil or a refrigerant through piping threading the stator laminations for increased cooling effect; (4) space economy, improved vacuum and capital saving of refrigerant-cooled condensers, and (5) the relationship between the natural vibration of turbine blades and the product of the r.p.m. and number of stationary vanes in the corresponding diaphragms.

Now that a generator voltage of 22,000 is considered quite conservative, possibly more users will take advantage of the economies in circuit breakers, switches, bus-bars, etc., made possible by utilizing higher generator voltages. As pointed out by Mr. Henderson, it is not desirable to call for a high short-circuit ratio, because it will limit the rating of a given-size generator and increase the cost per kilowatt.

* * * *

When Will the Electrical Industry Talk to Its Public?

"ADVERTISING is the principal means whereby business talks to its public." That is about as accurate a definition of advertising as has been made. The electric power industry of this country should adopt this means of talking plainly to its public. It has tried whispering in back rooms; it has tried speech making from platforms; it has tried many methods of propaganda; it has done some advertising in fits and starts. It has never, as an industry, tried plain, honest, continuous, forthright advertising—such as has won and held popular attention and interest for certain other products and industries.

The central-station companies are "due" to try advertising in this way as a means of talking to the public. They will make a terrible mess of it at first, no doubt, but they are too intelligent to do it badly for long. They will buy straight-in-line advertising brains. They will hire the educated pencils of keen-visioned copy men, the deft fingers and vivid palettes of capable commercial artists, the finely balanced skill of expert typographers. Advertising, they will find, is no harder to produce than electrical energy. They will make a success of it. The unsettled and unsettling question is—when?

* * * *

Vertical Distribution a Possibility

IN THE skyscraper areas of large cities it may be economical and convenient to institute vertical distribution of electricity. The number of floors and the load per floor makes the cost of copper and of regulation a very large item when low-voltage distribution from street levels is used. In future developments high-tension cables set in concrete rising from the bottom to the top of the tall buildings may be used. Feeders at the top and bottom of the buildings could be used, and at each floor a transformer station could be located for service applications. For some areas such a plan would seem well worth study by the industry.

Fighting Winter With Strategy

LOW towers and short spans are used by the New England Power Company for its 66-kv. line at the summit of Florida Mountain on the Mohawk Trail, to gain shelter from storms. The 120-kv. line of the Rochester Gas & Electric Company at Yates Crossing, near Rochester, N. Y., rises high above the winter-bound levels.

Tests of Arrester Grounds

Emphasize necessity of initially and periodically measuring resistance of ground electrodes. The effects of multiple grounds, spacing, soil conditions and treating soil with various salts. Permanency and corrosive test methods

By Edward Beck

Supply Engineer Westinghouse Electric & Manufacturing Company

LIGHTNING arresters cannot reduce transient voltages to a value that will not harm protected apparatus if hampered by high ground resistance. The degree to which ground resistance interferes with the performance of an arrester is apparent from one of the accompanying curves relating to a 3,000-volt auto-valve unit subjected to a 70-kv. (crest) surge. With zero ground resistance, the protection obtained was good, the surge voltage being reduced to approximately 10 kv. (crest). With a ground resistance of 50 ohms in the arrester circuit, the voltage from line to earth was doubled. Under similar conditions a transformer on a 2,300-volt line might be expected to fail.

The importance of low-resistance grounds cannot be overemphasized. Too little attention has been given to this phase of the protection problem. If it is intended to protect an electrical system against lightning and if money is to be expended for lightning arresters, it is worth while to add slightly to this expense for the purpose of not only making but also maintaining adequate grounds. This extra effort will repay itself in the ensuing reduction of lightning troubles.

Except where the conductivity of the soil is very poor, driven grounds consisting of pipes or rods forced into the earth give satisfactory resistances, are the easiest to install and consequently are desirable. Where one driven electrode does not furnish a ground of low enough resistance, multiple grounds may be made easily. If further reduction in resistance is necessary, treatment of the soil with a salt must be resorted to.

Information Sought

Although many data have been collected by other investigators, there appears to be a lack of comparative information on the characteristics of the different types of driven grounds commonly applied to lightning arresters. Consequently an investigation was undertaken with the purpose of securing answers to the following questions:

1. What reduction in resistance may be obtained by the use of suitable multiple electrode grounds?
2. What reduction is realized by applying various salts to the earth adjacent to the electrodes?
3. How quickly after applying the salts are these effects obtained?
4. How long may the effect be expected to last?
5. What is the corrosive influence of these salts on the materials generally used for electrodes?
6. To summarize, what type of ground is the most economical to use?

This investigation was made entirely on driven grounds; other conditions requiring different types are considered special. However, the data here presented may be applied to any type of ground electrode. The experimental installation of ground electrodes was made near broadcasting station K D K A, in East Pittsburgh, in June, 1926. It is intended to observe these grounds for several years.

Although it is too early to make any observations on the degree of corrosion caused by different salts on the different materials used for electrodes and too early to determine the length of time that the effects of salting the earth may last, observation to date may be of interest. The complete program calls for further observations on these electrodes to determine when the effect of the salts will disappear and removal of the electrodes at the end of three or four years to examine them for corrosion.

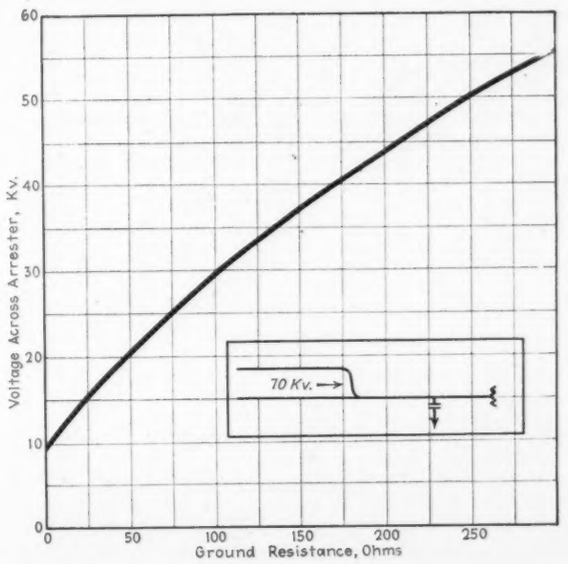


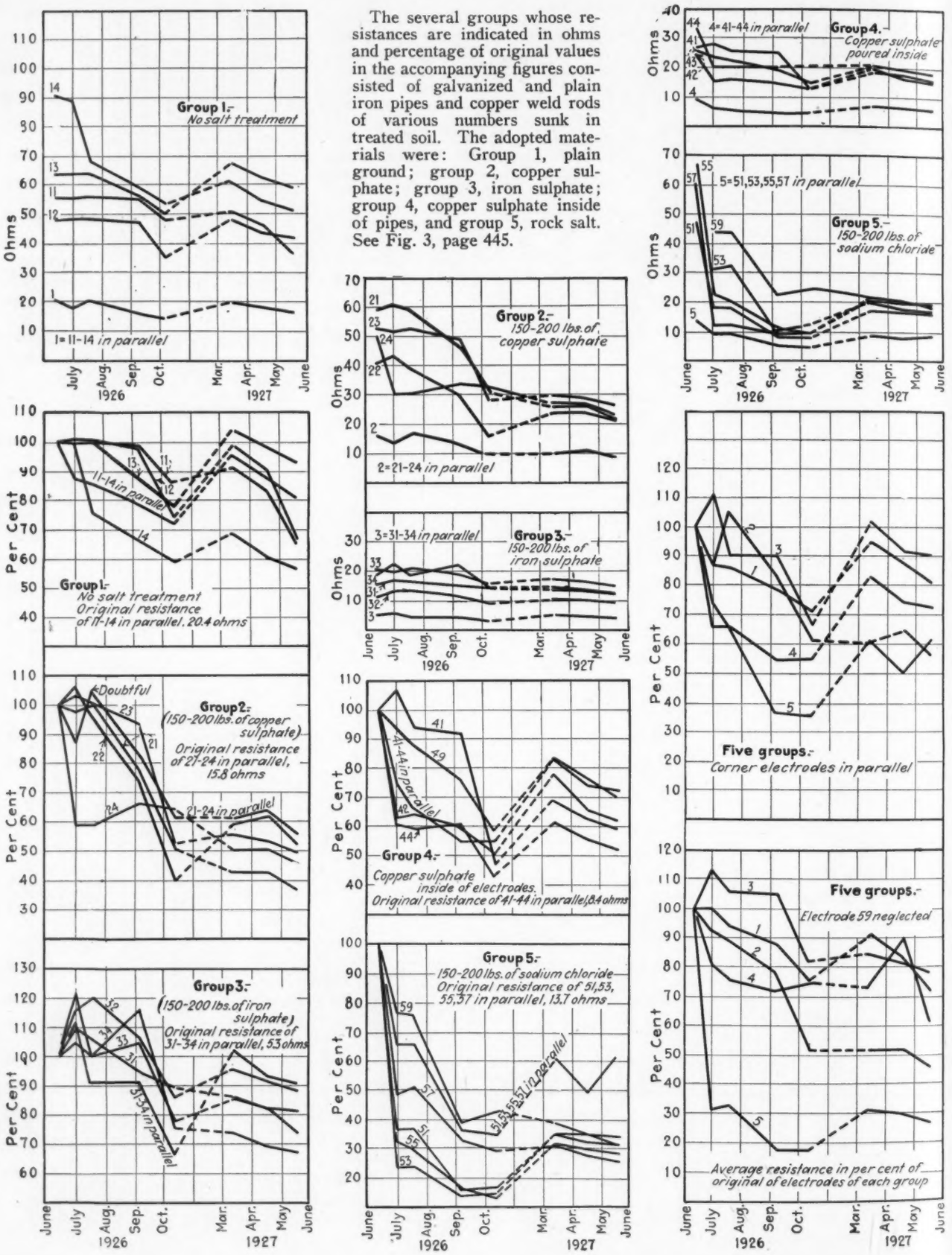
Fig. 1—Effect of ground resistance on performance of 3,000-volt type LV auto-valve lightning arrester

The curve was derived by means of DuFour oscillograph with arrester at transformer at end of line and subjected to a 70-kv. (crest) surge. Excluding direct strokes, it was considered that this would be the maximum surge that might be expected on a 2,300-volt line.

It was endeavored to make the installation typical of good practice in lightning arrester grounds. Numerous facts about grounds have been determined by other investigators. For instance, we know that the diameter of electrodes which can be driven and the material of which they consist have a negligible effect on the resistance, that increasing the depth of driving beyond 6 ft.

Fig. 2—Variations in Resistance of 31 Ground Electrodes Over Period of Year

The several groups whose resistances are indicated in ohms and percentage of original values in the accompanying figures consisted of galvanized and plain iron pipes and copper weld rods of various numbers sunk in treated soil. The adopted materials were: Group 1, plain ground; group 2, copper sulphate; group 3, iron sulphate; group 4, copper sulphate inside of pipes, and group 5, rock salt. See Fig. 3, page 445.


Ohms
Group 1.- No salt treatment
1=11-14 in parallel
Per Cent
11-14 in parallel
14
Group 1.- No salt treatment Original resistance of 11-14 in parallel, 20.4 ohms
Doubtful
Group 2.- (150-200 lbs. of copper sulphate) Original resistance of 21-24 in parallel, 15.8 ohms
21-24 in parallel
Group 3.- (150-200 lbs. of iron sulphate) Original resistance of 31-34 in parallel, 53 ohms
31-34 in parallel
Group 2.- 150-200 lbs. of copper sulphate
2=21-24 in parallel
3=31-34 in parallel
Group 3.- 150-200 lbs. of iron sulphate
41-44 in parallel
Group 4.- Copper sulphate inside of electrodes. Original resistance of 41-44 in parallel, 8.4 ohms
Group 5.- 150-200 lbs. of sodium chloride Original resistance of 51,53, 55,57 in parallel, 13.7 ohms
51,53,55,57 in parallel
4=41-44 in parallel
Group 4.- Copper sulphate poured inside
5=51,53,55,57 in parallel
Group 5.- 150-200 lbs. of sodium chloride
Five groups.- Corner electrodes in parallel
Five groups.- Electrode 59 neglected
Average resistance in per cent of original of electrodes of each group
June July Aug. Sep. Oct. Mar. Apr. May June
1926
1927

is of little benefit except in very dry localities, that the minimum spacing between multiple electrodes should be 6 ft., and that salt, if used, should be applied liberally if an appreciable reduction in the ground resistance is to be secured.

Bearing these things in mind, five groups of electrodes were installed as illustrated. The plain iron pipes external to the square formed by the other electrodes were driven to observe the corrosive effect only, resistance

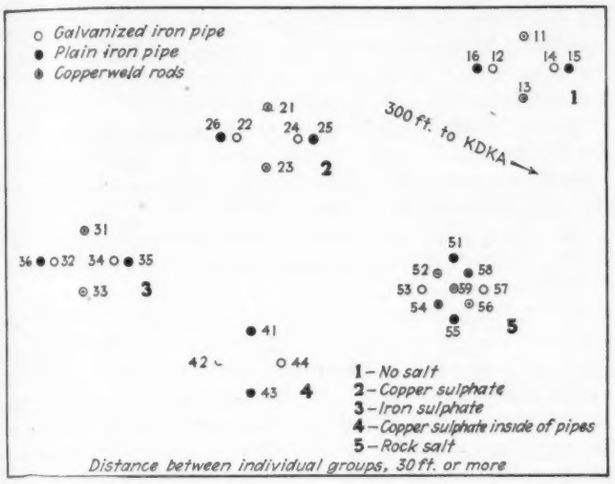

Galvanized iron pipe
Plain iron pipe
Copperweld rods
300 ft. to KDKA
1 – No salt
2 – Copper sulphate
3 – Iron sulphate
4 – Copper sulphate inside of pipes
5 – Rock salt
Distance between individual groups, 30 ft. or more

Fig. 3—Five groupings of ground electrodes were tested under different conditions

Nature of soil, yellow clay interspersed with shale; rainfall, averages 36 in. per year; location, top of hill, sloping off from group 1 toward 3 and 4 by about 10 ft.; diameter of pipes, 2 in., of rods, 1 in.; spacing between corner pipes, 6 ft., external iron pipes 2 ft. from corners; depth to which driven, 8 to 9 ft.; salts applied to groups 2, 3 and 5 by pouring into a shallow trench surrounding the electrode square.

Group 1, two galvanized iron pipes, two copper-weld rods and two plain iron pipes, no salt, located on the highest elevation; group 2, two galvanized iron pipes, two copper-weld rods, two plain iron pipes, 150 to 200 lb. of copper sulphate; group 3, two galvanized iron pipes, two copper-weld rods, two plain iron pipes, 150 to 200 lb. of iron sulphate. Located in slight depression; group 4, four galvanized and two plain iron pipes, with numerous holes drilled in them, copper sulphate solution poured inside of pipes; group 5, two galvanized iron pipes, two plain iron pipes, five copper-weld rods, 150 to 200 lb. of rock salt (sodium chloride).

measurements being confined to the others. Group 5 consists of nine electrodes, to permit observation of the effect of electrodes at reduced spacings and of increasing the number of electrodes in a given area.

As it is impracticable to use coke with driven grounds, the treatment of the soil surrounding the grounds was confined to the application of salts. Those most commonly employed are rock salt and copper sulphate; therefore these were used. A group using iron sulphate was added because this substance is cheap and has about the same conductivity in solution as copper sulphate. It is therefore worthy of consideration as a remedy for high resistance.

The arrangement of four electrodes in a square was chosen because this would be suitable for a multiple lightning arrester ground and furnish data on multiple grounds where the resistance of one electrode alone is too high. The resistances of the electrodes comprising corners of the squares were measured individually and in multiple about once a month except during the winter. No measurements were made during the winter for several reasons. One reason is that thunderstorms are rare when the weather is cold, hence there is no interest attached to the resistances in winter; also the behavior of ground resistances during the time the ground is frozen is well known. (See reference 1 in bibliography, page 447.)

Resistance measurements were made by means of the alternating-current volt-ampere method, using the ground of KDKA as a return. The broadcasting ground was checked occasionally by the three-point method. It was found to be quite constant between 0.3 and 0.4 ohm. It consists of a network of copper strap buried in coke and paralleled with the water-pipe system.

A small two-winding transformer was used to furnish the measuring current. This transformer was equipped with several voltage taps on the secondary. The apparatus is portable (weighing about 50 lb., including meters) and can be carried by one man. The primary is fed through a long cable, kept on a reel, from the 110-volt circuits of K D K A. Currents of the order of 5 to 15 amp. were used for measuring where possible. Checks on the same grounds were made, using currents of the order of 100 milliamperes. No marked deviation from the measurements at higher currents was found. Sometimes the indication was 5 to 10 per cent greater with the small currents. Apparently current strengths varying over a considerable range have no effect on the resistance. That this is so is further demonstrated by the accompanying volt-ampere characteristic made of a column of soil under pressure by means of the DuFour cathode ray oscillograph.

In the author's opinion, there is no apparent reason why the behavior of a low-resistance ground carrying a heavy current should be different from that of a high-resistance ground carrying a small current. It was found impracticable to set up a circuit consisting of earth in the laboratory with low enough resistance to permit the flow of currents of the magnitude of those caused by lightning. It is hoped to obtain such data in the field this summer. However, the maximum current it is practicable to use for measuring ground resistance is not much more than 20 amp., so that from the standpoint of measuring, the soil volt-ampere characteristic is of value. From the foregoing it seems safe to expect a reasonable accuracy if portable instruments of the bridge or ohmmeter types are used to measure lightning arrester grounds, provided they make use of alternating measuring current, although these instruments generate only small currents.

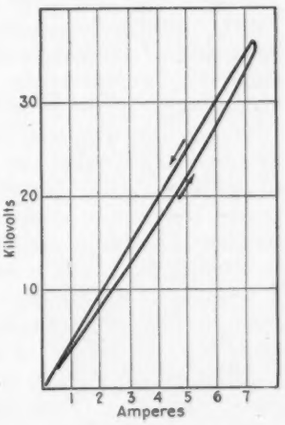


FIG. 4—VOLT-AMPERE CHARACTERISTICS OF 2¼x6-IN. COLUMN OF DAMP SOIL SHOW THAT CURRENT HAS LITTLE EFFECT ON RESISTANCE

Voltage impressed by condenser discharge simulating lightning transient. Resistance calculated from oscillogram was 4,900 ohms; at 110 volts, 60 cycles, 5,000 ohms. Since maximum current was only 8 amp., the results shed no light on behavior of ground electrodes under heavy surge currents.

The variations in resistances of the individual grounds observed during about a year are depicted. The first measurements were made the day after the electrodes were installed; therefore the salts applied to them had not taken effect. The salts began to lower the resistances not long afterward. The measurements indicate that the resistances of the installations treated with common rock salt decrease more rapidly and reach a lower value than those treated with either copper or

iron sulphate. (See particularly Fig. 2, "Five groups.") To ascertain whether this conclusion is reasonable, the solubilities of the salts used and the electrical conductivities of their solutions were examined. Their characteristics are illustrated. From these curves it may be seen that common salt is more soluble than either of the two others; also that the conductivity of its solution is about five times that of theirs. It is therefore to be expected that treatment with common salt will produce a lower ground resistance in less time than treatment

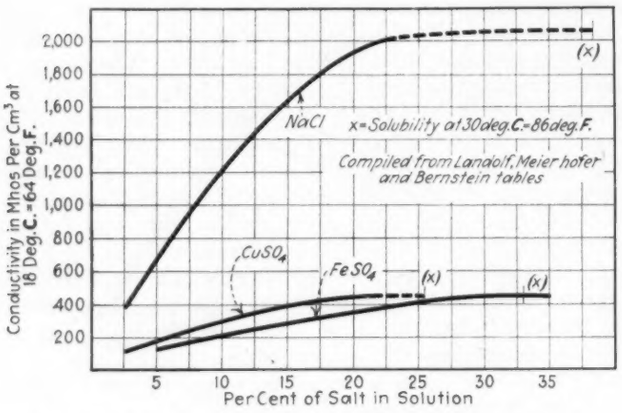


FIG. 5—COMPARATIVE CONDUCTIVITIES OF SALT SOLUTIONS

with other salts. That a reduction in resistance is effected by the salt is shown by the action of the various electrodes in group 5, Fig. 2, page 444. The resistances of the outer electrodes of this group (Nos. 51 to 58) decrease very soon after the application of the salt, whereas the resistance of the center rod (No. 59) remained high for some time and then decreased more slowly, ultimately reaching almost the same value of resistance as the other rods. This occurred because some time elapsed before the salt solution permeated from the outside of the group to the center rod.

It was felt that the results of measurements on one group of electrodes did not present conclusive proof of the electrical superiority of rock salt. It was suspected that the progress of the resistances might, in a measure, be due to the character of the soil at that particular location. Consequently in the spring of 1927 a second set of electrode groups was installed in the same locality, removed about 150 ft. from those already driven. This second installation practically duplicated the first except that, to simplify the installation, copper-coated steel rods were used in all but one installation, in which it was desired to observe the effect of pouring salt solution inside of the electrodes. This installation consisted of only four electrodes per group, as it is felt that the data on corrosion could be obtained with the original installation. The rods were 8 ft. apart instead of 6 ft., in order to observe whether there is any material benefit attached to this increased spacing. The results of the measurements to date on the second installation are presented in Fig. 6.

Unfortunately for the comparison, the resistances of the electrodes of the second installation were all much lower than those of the first. However, the graphs again indicate the rapid fall in resistance of those electrodes treated with common rock salt.

The differences in initial resistances of various groups in the first and second installations are interesting because they show the wide divergence that may be expected in comparatively small areas of ground. This emphasizes the need of measuring the resistance of all grounds made in order to determine their value. It is not sufficient to drive an electrode 10 ft. deep and assume therefore that a good ground has been made. It was found, in general, that those electrodes which were driven with the least effort had the lowest resistance. In some cases it was impossible to install the electrodes without first digging a hole. Those electrodes which pass through shale generally had a high resistance. For instance, electrode 14 required much effort to sink it to the required depth, as it was necessary to penetrate considerable shale. Its initial resistance was 90 ohms. As time went on and the earth became well packed around the electrode, its resistance decreased. The rods of group 3 were fairly easy to install; moreover, they are located in a slight hollow where moisture probably gathers; consequently they initially had between 11 and 20 ohms resistance. The electrodes of group 6 are driven close by a tiny stream; their resistances are low, yet not appreciably lower than those of other groups of the second installation.

The reduction in resistance which salting causes in the case of the electrodes which are initially low is apparently much less than that obtained on electrodes which are initially high. It appears that the resistances of electrodes of a salted group gradually fall to about the same value. This is probably so because the salted region of the earth acts like one large electrode for which the driven rods or pipes are terminal posts.

Effects of Paralleling and Spacing

If the measured resistances of rods in parallel are compared with values calculated from the resistances of the individual rods, it is found that the ratio of the actual to the calculated is of the order of 1.5 to 1.7 except where the resistances are high, in which case the ratio may be nearer to 1. For instance, the measured resistance of the four electrodes of each group in multiple were compared with the theoretical resistance calculated by the formula $\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} \ldots + \frac{1}{r_n}$ The results are given in the accompanying table.

It appears that the gain in paralleling electrodes is less where the soil resistance is low than where it is high.

Measurements made on the nine electrodes of group 5 for the purpose of checking the benefits of driving electrodes at close spacings or of adding electrodes in a given space gave the results also shown in the table. These measurements were made at the beginning of the

MEASURED RESISTANCE COMPARED WITH THEORETICAL (OHMS)

Group	Calculated	Measured	Ratio (M ÷ C)
1	13.9	19.5	1.40
2	6.7	9.6	1.43
3	3.4	5.4	1.59
4	5.0	7.0	1.40
5	4.8	8.4	1.75
6	2.0	3.3	1.65
7	1.7	3.0	1.77
8	2.9	5.0	1.73
9	3.3	5.9	1.79
10	2.5	4.7	1.88

	Electrodes in Parallel	Resistance (Ohms) Measured	Calculated	Ratio (M ÷ C)
(1)	51, 53, 55, 57	14.0	14.1	1.0
(2)	51, 53, 55, 57, 59	13.6	10.3	1.3
(3)	51 to 58	12.9	7.2	1.8
(4)	56, 57, 58, 59	22.3	14.3	1.6

Ratio of (4) to (1)—that is, 3-ft. to 6-ft. spacing—is 1.6.

investigation. The resistances of the individual electrodes of group 5 varied between 47 and 67 ohms.

These tabulations indicate that closer spacings than 6 ft. are not to be recommended, that increasing the spacing beyond 6 ft. is not worth the trouble and that additional rods in a 6-ft. square are not economical.

Conclusions

It is too early to draw definite conclusions regarding the ultimate superiority of a certain salt or a certain electrode material, as the degree of corrosion and the duration of the salting effect cannot be evaluated at this time. Therefore the questions propounded earlier in this article cannot all be definitely answered.

The reductions in resistance that can be obtained by using parallel grounds and by salting are shown.

The question of how quickly the salts take effect may be answered by the statement that in the case of rock salt an appreciable reduction may be realized in about two weeks, but a longer time must elapse in the case of other salts unless the solution is poured around the electrodes, as was done in group 4. The time necessary for the salts to become effective undoubtedly depends on the nature of the soil, and the results obtained at East Pittsburgh may not apply to other localities.

How long the effect lasts has not yet been determined; it appears that it will last at least a year, however.

The most economical ground to use is still undetermined, because the lasting effect of salting and the corrosive effect are not definitely known. Prof. O. B. Wooten (see reference 2 in bibliography) has stated that pipes imbedded in soil treated with rock salt show little corrosion after two years.

From the electrical standpoint, rock salt is the most efficacious in reducing the resistance of driven electrodes. From the first cost standpoint, it also has the advantage over copper sulphate. The costs of the salt used in carload lots at Pittsburgh are as follows per 100 lb.: Copper sulphate, $4.30; iron sulphate, $1.40; rock salt, $1.95.

From the standpoint of ease of installation, the rods possess a distinct advantage. Pipes require driving points and caps and must in general be larger in diameter than rods of equivalent mechanical strength; therefore they require additional effort to drive them.

Treating the soil by pouring electrolyte inside of pipe electrodes that have been drilled with numerous holes apparently possesses certain advantages, as the electrolyte takes effect quickly and it is simple to repeat the treatment. The cost of such an installation is higher. It is doubtful whether the advantages derived outweigh the increase in cost.

No attempt has been made to discuss methods of making earth connections in unfavorable soils. Grounds of that character require special methods, usually costly.

There is one point which the author wishes to stress emphatically. It is that measurement of the resistance of grounds is essentially from the protective and the economic standpoints. If one electrode provides a sufficiently low resistance, it is patently uneconomical to drive more or to salt the earth. Moreover, it is only by measuring the resistance of the ground when it is installed that the necessity for additional electrodes or salting becomes apparent.

Regarding the frequency with which the resistances should be checked, it appears from the data here collected that once a year is sufficient; perhaps the interval may safely be longer. The measurement should preferably be made in April or May. It is to be recommended

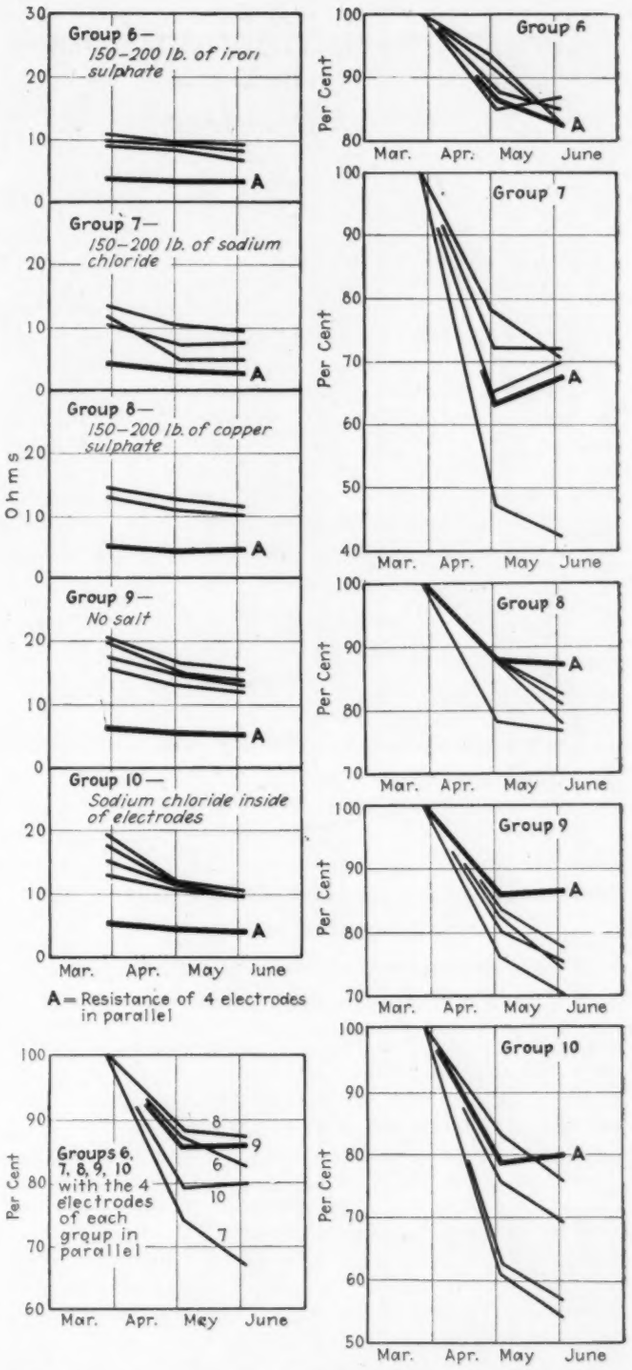

Group 6— 150–200 lb. of iron sulphate
Group 7— 150–200 lb. of sodium chloride
Group 8— 150–200 lb. of copper sulphate
Group 9— No salt
Group 10— Sodium chloride inside of electrodes
Ohms
Mar. Apr. May June
A = Resistance of 4 electrodes in parallel
Groups 6, 7, 8, 9, 10 with the 4 electrodes of each group in parallel
Per Cent
Group 6
Group 7
Group 8
Group 9
Group 10

FIG. 6—RESISTANCE OF FIVE GROUPS OF ELECTRODES USING COPPER-COATED STEEL RODS SPACED 8 FT. INSTEAD OF 6 FT.

that in addition to measuring each ground when it is installed, a second test be made about two weeks later.

The author wishes to take this opportunity to express to R. M. Keller, J. B. Leinbach and O. Ackerman his appreciation of their co-operation in conducting this investigation.

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2. O. B. Wooten, "The Resistance of Electrical Ground Connections." Bulletin 10 of Agricultural and Mechanical College of Texas.

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Reducing Distribution Losses

TENTH ARTICLE

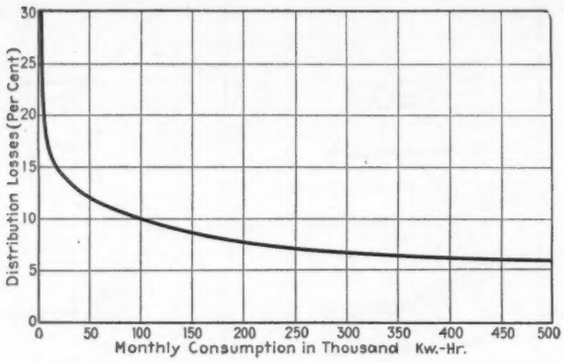
Results Obtained on One System

By J. B. Moorhouse

Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.

THE economical operation of an electric utility requires consideration of all factors involving operating expense. Where greatest savings may be made the greatest effort should be expended to produce that saving. Power stations have received their share of attention in improvement of design and methods of operation with most gratifying results. As indicated in the previous articles of this series transmission and distribution systems offer a field for further development in reducing losses and improving service and concrete evidence is offered in this the final installment.

The amount of money which may be spent in investi-



DISTRIBUTION LOSSES EXPRESSED AS A FUNCTION OF ENERGY CONSUMPTION

gating losses and for reconstruction purposes depends upon the amount which can be saved by the improved system. It is evident that the return on a town of 300 average customers will not warrant the expense of a detailed survey for loss reduction. Cities of 5,000 population and above which have high unaccounted for losses justify the cost of a detailed survey to the extent of using graphic instruments where needed.

The trend of loss reductions of thirteen towns in the territory served by the Central Illinois Public Service Company is shown in the table. The tabulation is prepared from monthly loss reports over a period of nineteen months. It may be observed that the losses in these towns are approaching values indicated in the accompanying curve. The greatest savings were realized in towns "C" and "I," the least in towns "B," "K," "H" and "M," indicating there was little relationship between community consumption and potential loss reductions. Town "F" of the above list had poorly located distribution transformers of excess capacity. When reconstruction was carried on 84 kva. was removed from the town, leaving 202 kva., yet service was greatly improved. Town "J" is in a coal mining district where it is difficult to plan overhead construction due to the variation in number of customers. Town "L" is located in a flood area; emergency use of unmetered electrical energy raises the loss percentage above normal. Service in town "M" is furnished to several canning companies, whose power load is heavy for a few weeks only. Service to these companies is transferred from small transformer banks to large banks during the canning season, thereby minimizing transformer losses. The variety of conditions encountered makes it necessary for the distribution man to familiarize himself with local conditions before making recommendations for reconstruction.

TABLE OF LOSS REDUCTIONS

Town	Kw.-Hr. Per Year Supplied to Distribution System	Per Cent Loss Before Survey	Per Cent Loss After Survey and Reconstruction
A	110,000	45	39
B	156,000	26	24
C	216,000	45	22
D	252,000	25	14
E	252,000	27	19
F	264,000	22	16
G	276,000	27	18
H	516,000	24	19
I	1,020,000	38	17
J	1,080,000	27	19
K	1,680,000	18	14
L	2,640,000	21	14
M	4,245,000	10	5

Net Cost of Condensing-Water Conduits

IN THE accompanying table are given the estimated installed costs of various condensing-water conduits, exclusive of overhead charges during construction such as organization, engineering, interest, etc., derived from a reproduction cost appraisal of an Eastern central station located on tidewater after a comprehensive survey of the property. Included in these data are also a group of similar net costs taken from the company's field sheets in connection with an extension made during 1925. All data presented, unless otherwise indicated, are based on 1927 figures.

MISCELLANEOUS NET COST DATA FOR CONDENSING-WATER TUNNELS (NO OVERHEAD)

Intake tunnel, 322 ft. long, circular brick, inside diameter 6 ft. 6 in., walls 12 in. thick	$36,788
Intake tunnel, 94 ft. long, other dimensions as above, brick	9,336
Discharge tunnel, 186 ft. long, reinforced concrete, inside dimensions 4 ft. x 5 ft., walls 8 in. and 16 in. thick, roof slab 12 in. thick, inside face of side walls waterproofed with felt and pitch, with 4-in. brick protection course	5,196
Discharge tunnel, 87 ft. long, reinforced concrete, 4 ft. x 5 ft. inside dimensions, wall 3 in. thick on one side and 16 in. thick on other, roof slab 12 in. thick, waterproofed as above	2,354
(For contractor's compensation add 5 per cent to above)	
INTAKE SCREENS	
Two Link Belt vertical intake screening elevators, 25 ft. 6 in. on centers; 5 ft. 6 in. screening panels of No. 9 BWG 1-in. square mesh screen cloth with steel framework; No. 4103 malleable iron closed joint pintle chain driving machinery, splash plate guards, spray pipes, valves and connections, driven by and including 5-hp., 550-volt, three-phase, 60-cycle motor with reduction gear and including steel framework for hoisting trash racks	7,644
(For contractor's compensation, add 5 per cent to above)	
1925 FIELD COSTS (net, no overhead)	
Intake and discharge tunnels, each reinforced concrete with 18-in. walls, floor and roof slabs. Intake, 463 ft. long with 7 ft. x 7 ft. inside dimensions and 86 ft. length of sizes ranging from 6 ft. x 6 ft. to 6 ft. x 7 ft., with manholes and gate wells Discharge, 143 ft. of 4 ft. x 7 ft. inside, 60 ft. about 5 ft. 6 in. x 8 ft. 6 in., 340 ft. about 5 ft. 6 in. x 12 ft., 10 ft. of 4 ft. 6 in. x 7 ft., and manholes and connections	241,937
Screen house substructure and well, 32 ft. 6 in. x 65 ft. x 36 ft. deep, reinforced concrete and structural steel, with six sluice gates 2 ft. x 9 ft., and six gates 2 ft. 6 in. x 7 ft. 6 in.	202,906
Intake screens 35 ft. 6 in. on centers, Link Belt, panels 8 ft. 11 in. wide, 5-hp. motor drive through reduction gear, and de-watering pump (1,100 gal. per minute) with 25-hp., 1,750-r.p.m. motor	13,771
Gate valve 5 ft. x 5 ft. (diameter) for tunnel between two units, bronze	1,182
(For contractor's compensation add 5 per cent to above)	

Large-Unit Foundations

By P. D. FREUDENBERGER
Chief Draftsman Buffalo General Electric Company, Buffalo, N. Y.

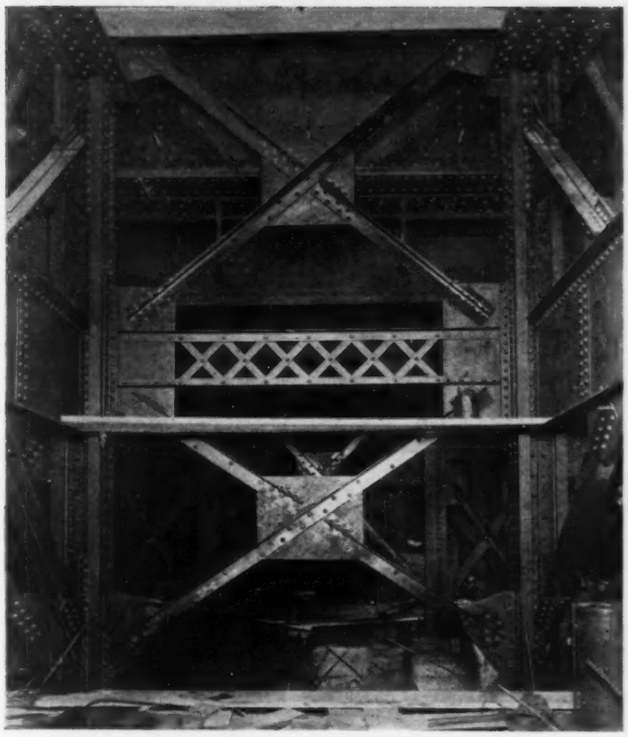
IN DESIGNING and constructing the foundation for the 60,000-kw. turbo-generator at the Charles R. Huntley station of the Buffalo General Electric Company a particular effort was made to hold the possible values of deflection due to dead and live loads within definite limits to prevent misalignment of the large new generating unit.

The total weight of this machine alone is 1,500,000 lb. This load, together with the condenser, piping and dead load, is supported on an isolated island 60 ft. high and resting on bedrock. The rock was located approximately 40 ft. below the grade and was found to be of very high structural strength. A sample tested to 26,000 lb. per square inch in direct compression.

The substructure for the foundation is made up of ten interlocking steel sheet pilings, concrete-filled caissons, with a concrete mat at the top. Stresses in the concrete were kept within the following limits:

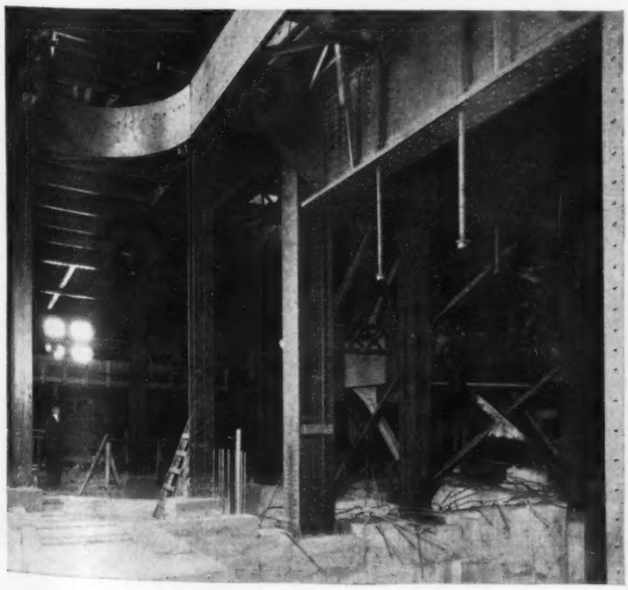
Direct compression, 400 lb. per square inch.
Combined compression and bending, 450 lb. per square inch.
Axial compression under column bases, 500 lb. per square inch.
Tension in reinforcing steel, 10,000 lb. per square inch.
No variation in deformation greater than 0.02 in. was permitted in the concrete shafts of the caissons.

The superstructure is made up of structural steel with a 4-in. covering of concrete. The concrete covering was requested by the manufacturer of the turbo-generator as an insulation against temperature changes. However, there are other advantages which warranted its use. The concrete covering forms a preservative against corrosion, is sound deadening and adds to the rigidity of the foundation in general.

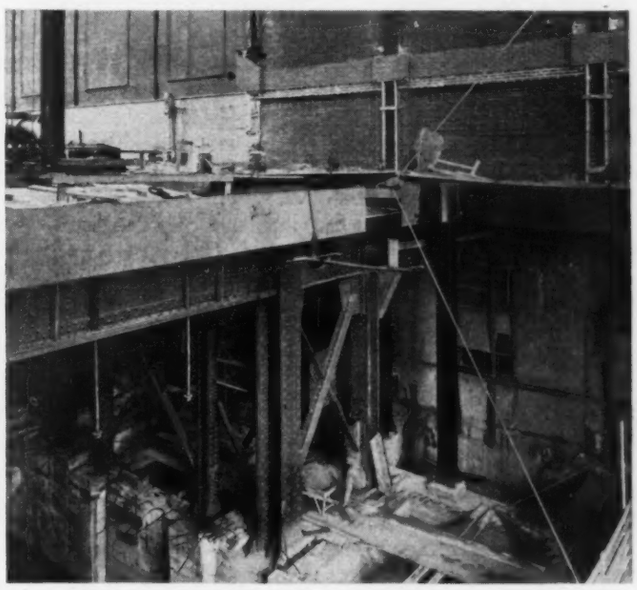


HEAVY BEAM BEYOND CROSS BRACING SUPPORTS CENTER BEARINGS OF THE UNIT

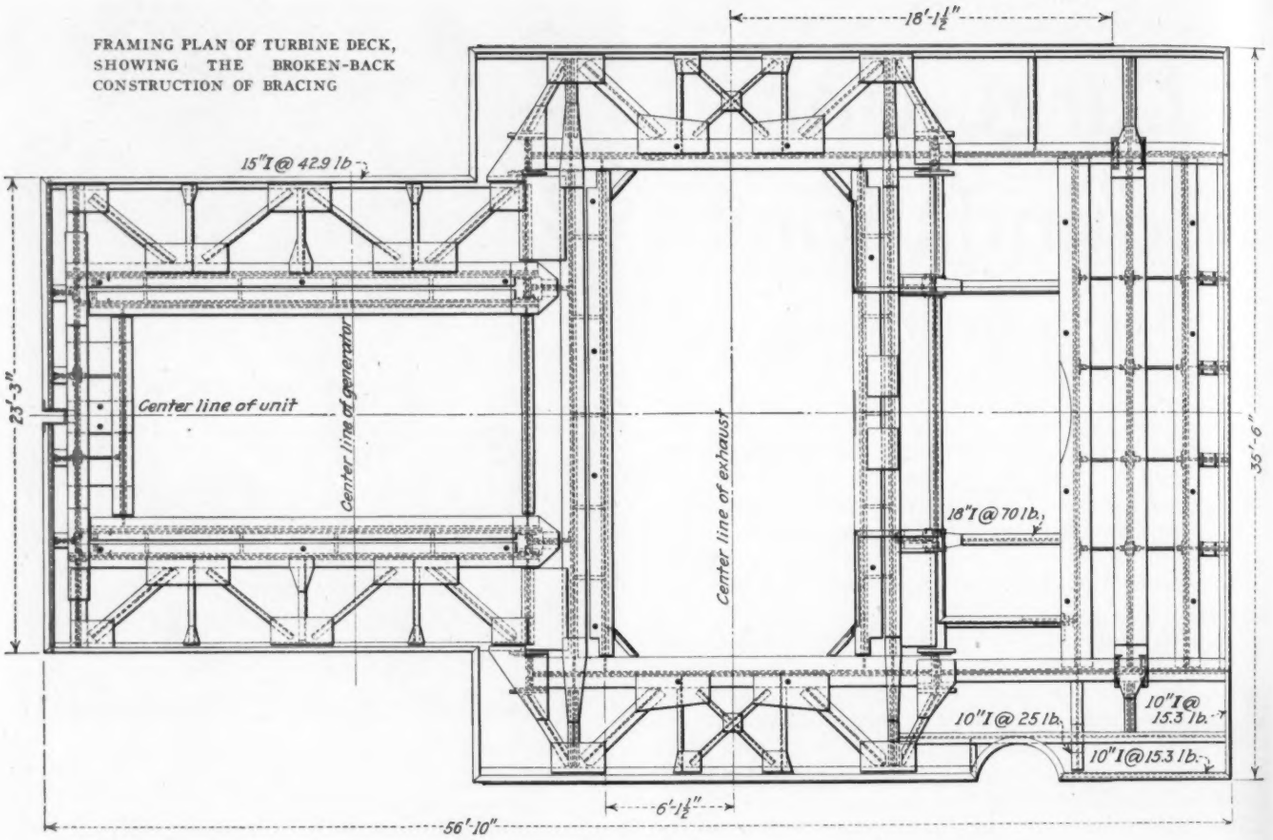
The size of the members forming the steel structure was determined by their deflection due to the dead load, plus 25 per cent of the turbine load as an allowance for impact. The deflection of the beams and girders was kept below 0.002 in. and that of the column shafts 0.04 in., with no variation at any point on the structure greater than 0.02 in. The 0.04-in. deformation referred to in the column shafts includes the dead load, the impact and the bracing stresses. The deformation due to the dead load



THE BRACING BETWEEN THE WIDELY SPACED COLUMNS ON THE RIGHT IS THE SAME AS SHOWN ABOVE



THE GAP IN THE STEEL FLASHBOARD AT THE TURBINE FLOOR LINE IS FOR THE THROTTLE VALVE



FRAMING PLAN OF TURBINE DECK, SHOWING THE BROKEN-BACK CONSTRUCTION OF BRACING

alone is below 0.02 in. The fiber stresses in the beams and girders is approximately 3,500 lb. per square inch throughout the structure.

The steel structure is braced in all directions to withstand shocks and make it rigid. In determining the stresses an arbitrary value of 25 per cent of the machine loads was considered as acting on the plane of the shaft. As the unit is located partly within an already existing building, the main girders could not be made continuous. This broken-back feature was taken care of by providing horizontal bracing in the main deck of the structural steel. Bracing members were designed with an allowable fiber stress of 16,000 lb. per square inch.

A novel method of obtaining the initial tension in the diagonals was employed. The amount of tension varied from 10,000 lb. to 30,000 lb. per member, depending upon its area in cross-section. It was necessary to use the varying values mentioned to produce measurable amounts of draw of from 0.01 in. to 0.015 in. The diagonals were not fabricated until the main members of the foundation were in their exact location and riveted. Each diagonal was then made from accurate measurements and templates taken in the field. The holes in the upper end of the member were made to size, while the ones in the lower end were sub-punched and at a location to allow for draw. With the diagonal in position the upper end was riveted. By means of four drift pins and a man with an air gun at either side, alternately tapping the pins with hammers, the diagonal was stretched to its required length. With the drift pins in place, the remaining holes in the connection were reamed and riveted. Finally the drift pins were removed, the holes reamed and riveted and the structure completed.

Stresses in the rivets were kept below usual values. The rivet values in shear for the primary members were 10,000 lb. per square inch for shop-driven rivets and 7,000 lb. per square inch when driven in the field. Many of the rivets have a very long grip, and at first some difficulty was encountered in making them tight. By double gunning and cooling the ends of the rivets no further difficulty was encountered.

Cost of Outdoor Station

AN UNUSUAL outdoor hydro plant of 30-kw. rating was described by Joseph Franz, engineer Southern Berkshire Power & Electric Company, Stockbridge, Mass., in the ELECTRICAL WORLD Dec. 31, 1927, page 1350. Since the article was prepared the accompanying cost data have been received in reference to the installation, which is of the induction-generator type with an 18-in. turbine running under a net head of 10½ ft. A concrete dam was already available for use when the hydro plant was built. The generator is provided with a galvanized iron umbrella, built by a local plumber, to insure additional protection against the elements, and its erection cost is included in the erection expense. The umbrella was erected by one man in about one day.

ITEMIZED COSTS OF 30-KW. HYDRO PLANT

Excavation and placing concrete flume	$1,002.05
Headgate and racks	88.05
Turbine, f.o.b. West Stockbridge	1,678.72
Generator, f.o.b. West Stockbridge	1,811.37
Circuit breaker	50.07
Galvanized iron hood	18.00
Miscellaneous material and carting	50.00
Labor erecting and connecting unit	411.15
Engineering and superintendence	650.00
Total installation	$5,759.41
Per kilowatt	$191.98

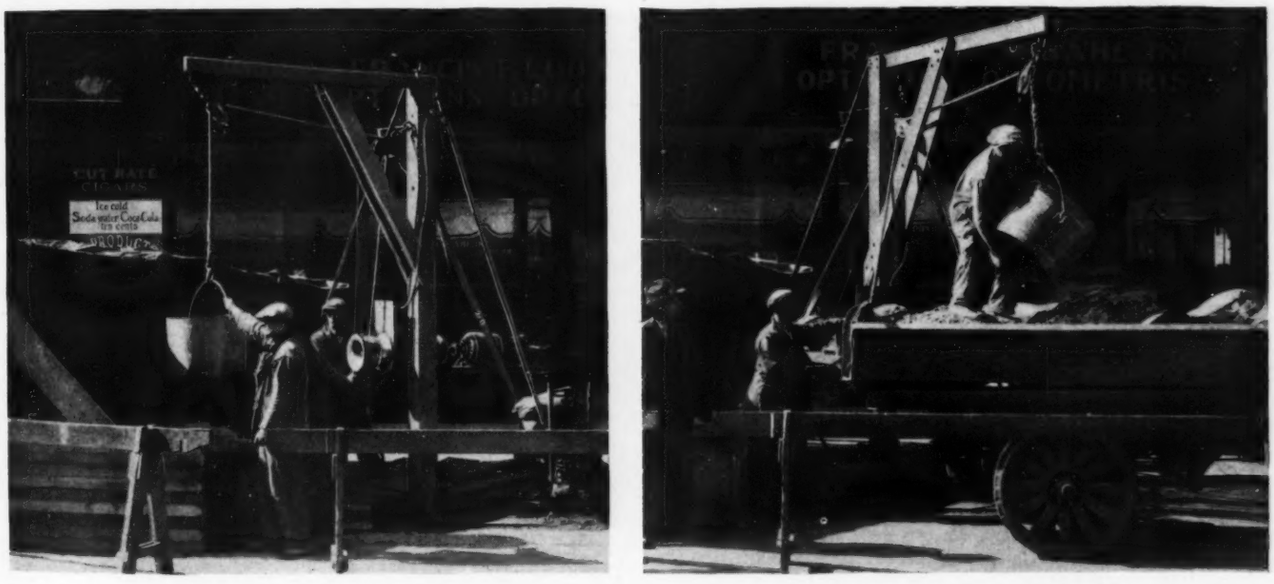
Light-Weight Manhole Hoist

By R. L. Dodd
General Foreman Underground Division,
Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

EXCAVATING deep manholes in busy city streets often presents a rather vexing problem in digging and disposal of the dirt. The dirt cannot be thrown up with shovels after the hole has gone down more than 6 or 7 ft. and quite frequently a city ordinance requires the immediate removal of the dirt. The use of winch-operated hoists in this work is not uncommon, but the hoists are not always easily portable and are not infrequently awkward and hard to handle. These difficulties have been pretty well disposed of in the hoist that is used by the underground division of the Milwaukee Electric Railway & Light Company.

This particular hoist was built by the company in the fall of 1927, has been in use since that time in the excavation of tunnel shafts and deep manholes and has performed very satisfactorily. The winch is the same as is used in building foundation caissons. It is a Thomas winch, equipped with a 2-hp. motor speed reduction gear, ratchet and large nigger head. The mast is 6 x 6-in. hardwood timber about 12 ft. long. The boom is a $3\frac{1}{4}$x$4\frac{1}{4}$-in. x 7-ft. hardwood crossarm reinforced with a $\frac{1}{8}$x$2\frac{1}{2}$-in. steel strap along the top. The boom braces are 2x6-in. soft wood. The back braces are $1\frac{1}{4}$-in. iron pipes, with the lower ends 7 ft. from the mast. The pivots at top and bottom of the mast are 1-in. bolts.

The winch is attached bodily to the mast by means of one bolt and three braces so that it revolves with the crane. The power supply is wired to the top of the back braces, thence to the mast and the motor through flexible leads. The lifting buckets are made of transformer oil barrels cut in half and bail hooks welded on. The capacity of the hoist is about 500 lb. at a speed of 40 ft. per minute. The operator runs the motor continuously and controls the speed of hoisting and lowering entirely with the 1-in. rope wrapped around the nigger head. The ratchet prevents dropping the bucket if the motor should stop. This hoist, on account of the simplicity of its construction and the light weight of its parts, can be disassembled, loaded on a truck, moved a reasonable distance and erected at the new location by four men in two hours.



LIGHT-WEIGHT HOIST BEING USED TO REMOVE EXCAVATED MATERIAL FROM TUNNEL AND LOAD A DIRT TRUCK

Western Utility Freight Bill Is No Small Item

THE results of a recent inquiry among a number of electric light and power companies in the Western States shed light on the magnitude of their annual freight bills. Although a number of companies were unable to make any definite statement, and others could only approximate the annual costs because transportation charges were included in the cost, it was possible to get data for four operating systems. To reduce them to a comparable basis they have been worked out in terms of dollars of freight charges per kilowatt of installed plant capacity, with the following results:

	Cents		Cents
Company A	62 to 78	Company C	87 to $1.15
Company B	67	Company D	$1.40

The figures for Company A are exclusive of charges for some new heavy machinery and, therefore, represent an average year when no considerable amount of new construction is going on. Company D included freight charges on a considerable amount of new construction, which apparently accounts for the high freight charges per kilowatt of plant.

In plant capacity these companies range from somewhat less than 100,000 kw. upward. It is not to be expected that the unit figures will agree even roughly. The items are too few to justify the taking of an average, but they seem to warrant the assumption of 67 cents of freight charges per kilowatt of plant as a reasonable minimum, though this is seriously affected by a number of factors, particularly the rapidity of growth and the distance of transporting fuel and machinery.

If it be granted that the samples are representative of conditions in the eleven Western States, with somewhat more than 3,500,000 kw. of plants, an estimate for the combined freight bills of that section is $2,500,000.

For the same systems the freight bill ranged from $2\frac{1}{2}$ cents to 8 cents per dollar of value of the freight.

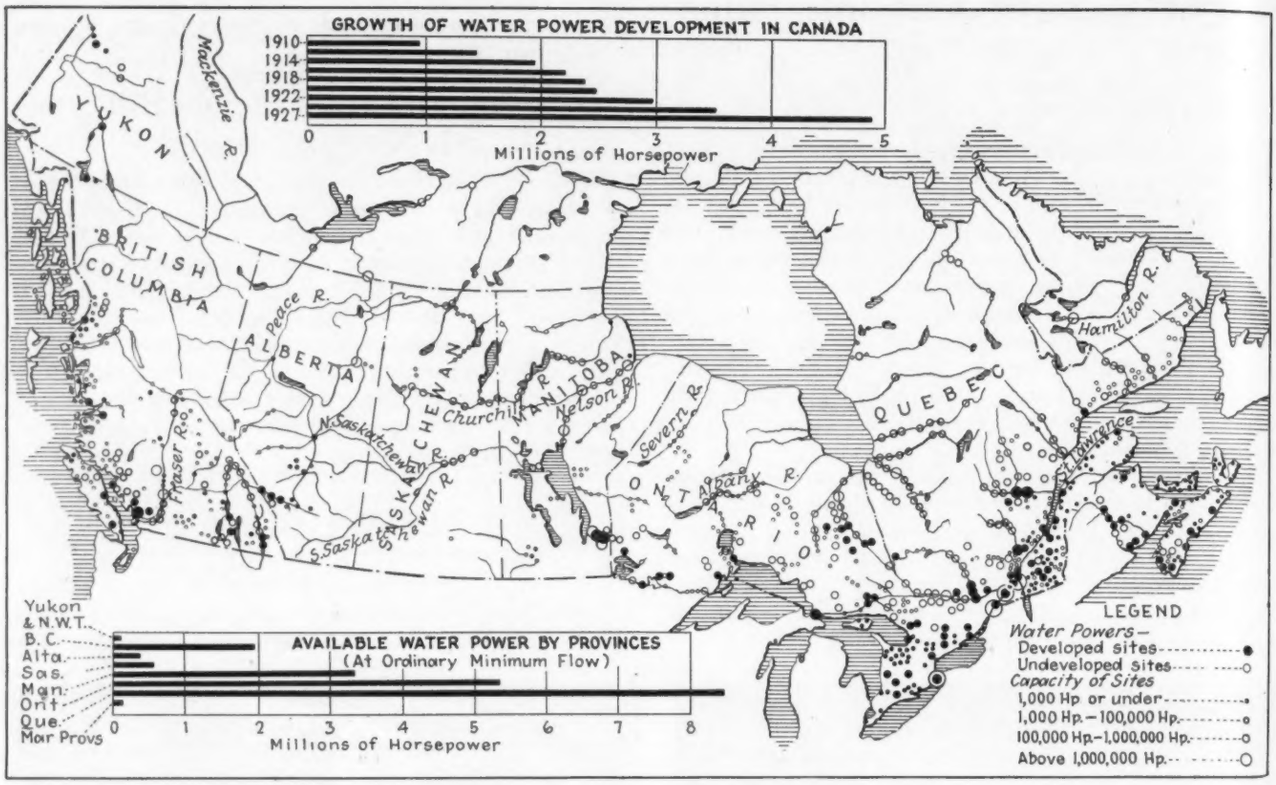


Fig. 1—Location and growth of Canada water powers

Table I—Customers by Provinces in Canada 1924-1925*

Province	Total Central Station Customers		Domestic Lighting Customers		Commercial Lighting Customers		Power Customers	
	1924	1925	1924	1925	1924	1925	1924	1925
Canada	**1,200,950**	**1,279,731**	**988,480**	**1,063,530**	**176,444**	**180,994**	**36,026**	**35,207**
Prince Edward Island	3,717	3,706	3,061	2,813	586	782	70	111
Nova Scotia	40,315	40,881	31,667	32,159	7,345	7,273	1,303	1,449
New Brunswick	27,759	30,676	21,955	24,483	5,040	5,367	764	826
Quebec	321,494	347,356	271,475	297,965	40,778	40,892	9,241	8,499
Ontario	507,038	534,513	416,376	441,622	76,575	78,415	14,087	14,476
Manitoba	92,511	102,831	76,260	86,616	12,678	13,269	3,573	2,946
Saskatchewan	41,807	44,394	32,219	34,188	7,962	8,475	1,626	1,731
Alberta	55,488	57,435	44,904	46,332	8,575	9,307	2,009	1,796
British Columbia	110,341	117,457	90,209	96,996	16,791	17,100	3,341	3,361
Yukon	480	482	354	356	114	114	12	12

*Dominion Bureau of Statistics.

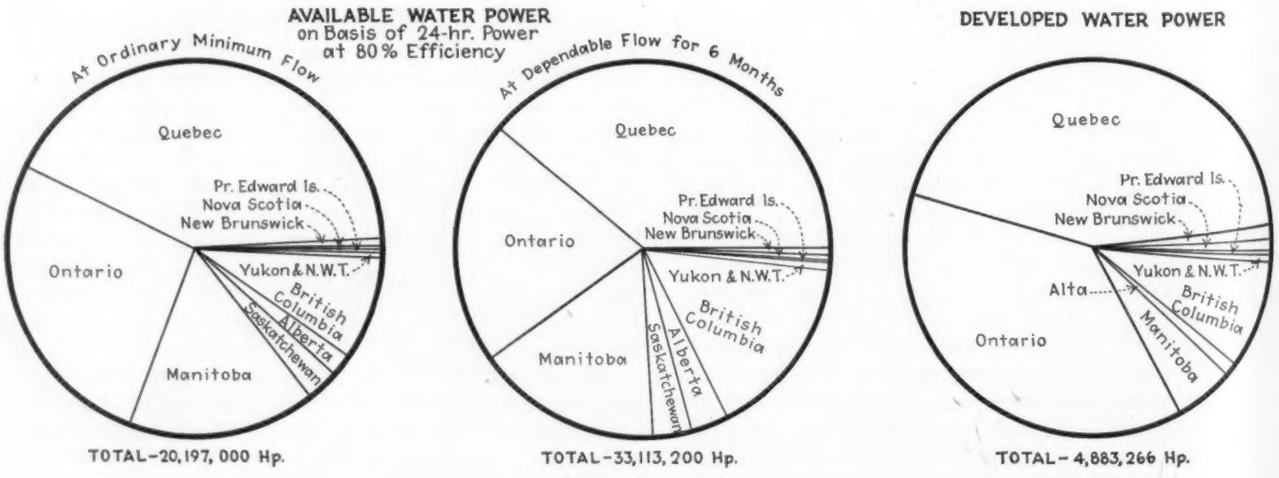


Fig. 2—Available water power of Canada on basis of 24-hour power at 80 per cent efficiency

Water Powers of Canada*

$900,000,000 invested in 5,000,000 hp. or about $180 per horsepower—33,000,000 hp. still available six months of year

CANADA has abundant water-power resources and they have been developed rapidly in late years. In 1910 the capital invested in water power was $121,000,000, and in 1927 it was $900,000,000—a growth of 600 per cent in seventeen years. The average capitalization per horsepower is $183 and there is a present-developed capacity of installed turbine horsepower of 4,883,266. The available 24-hour power at 80 per cent efficiency is 20,197,000 and that available on a six-month flow basis is 33,113,200. The total recorded resources would warrant the installation of about 43,000,000 hp., according to the Department of the Interior, Canada.*

The distribution of water-power resources is given in the accompanying table. It shows they are well distributed from coast to coast and in transmission distance of the larger cities. The growth in installation has been rapid as shown by the following data on horsepower installed: 1900, 170,000; 1910, 975,000; 1914, 1,946,000; 1920, 2,508,000; 1927, 4,883,000. Many projects are in prospect and it is expected that a rapid growth will continue.

The central stations utilize 4,012,428 hp.; the pulp and paper mills, 526,731 hp., while electrochemical and miscellaneous installations total 344,107 hp. The installation aggregates 5.13 hp. per capita. In the central-station industry there are 308 stations. Of these, 218, with an installation of 2,759,729 hp., are private plants, and 90, with an installation of 1,252,699 hp., are operated by public bodies.

New equipment installed and ready for operation during 1927 totaled 221,655 hp.; other undertakings were advanced to such a stage that additional installation to the extent of 378,000 hp. will be in place by midsummer of 1928, bringing the total for Canada to well over the five million mark, or double the installation at the end of 1920. Other developments in progress or definitely planned are expected to add another 2,000,000 hp. by the end of 1930.

Of the total hydraulic installation 82 per cent is in central electric stations. This percentage has been steadily rising and there is every indication that the trend will continue.

Next to these in magnitude of hydraulic power use is the pulp and paper industry, which, however, is also a heavy user of purchased energy. This industry has a total of 526,731 hp. in connection with the mills themselves and purchases additional energy from central electric stations estimated to represent the use of more than 831,000 hp., giving a total utilization of 1,358,052 hp. of hydro power.

Abstract of report of Water-Resources Paper, No. 60, Department of the Interior, Canada.

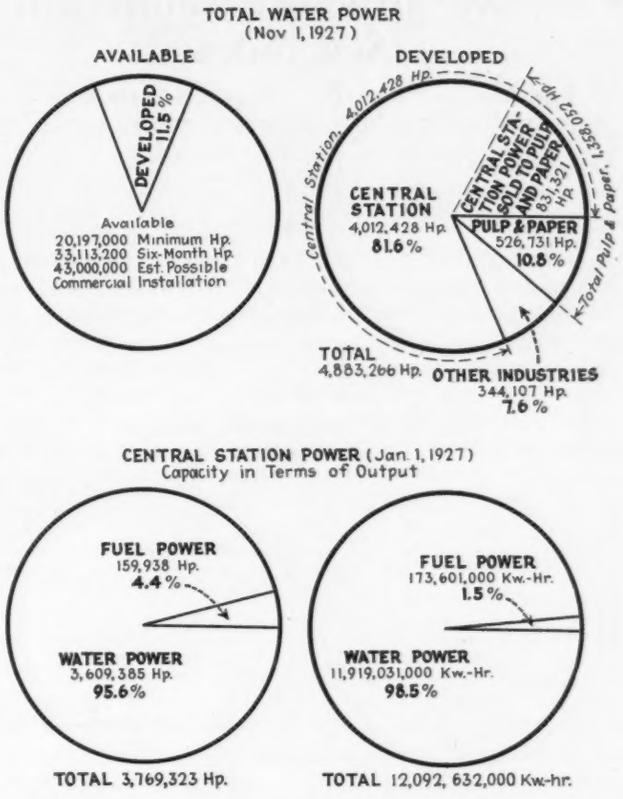


FIG. 3—UTILIZATION OF WATER-POWER RESOURCES OF CANADA

Table II—Distribution of the Developed Water Power in Canada (Nov. 1, 1927)

Province	Turbine Installation in Horsepower				Population June 1, 1927	Total Installation Per 1,000 Population, Hp.	Available 24-Hour Power at 80 Per Cent Efficiency		Turbine Installation, Hp.
	In Central Electric Stations	In Pulp and Paper Mills	In Other Industries	Total			At Ordinary Minimum Flow, Hp.	At Ordinary Six Months' Flow, Hp.	
1	2	3	4	5	6	7	8	9	10
British Columbia	330,679	80,500	61,883	473,062	575,000	822.0	1,931,000	5,103,500	473,062
Alberta	33,520	.....	587	34,107	617,000	55.0	390,000	1,049,500	34,107
Saskatchewan	.....	.....	35	35	836,000	0.04	542,000	1,082,000	35
Manitoba	238,725	.....	16,400	255,125	647,000	394.0	3,309,000	5,334,500	255,125
Ontario	1,544,766	174,548	107,774	1,827,088	3,187,000	573.0	5,330,000	6,940,000	1,827,088
Quebec	1,796,692	242,044	126,707	2,165,443	2,604,000	832.0	8,459,000	13,064,000	2,165,443
New Brunswick	25,825	13,003	8,403	47,231	411,000	115.0	87,000	120,800	47,231
Nova Scotia	31,942	16,636	17,124	65,702	543,000	121.0	20,800	128,300	65,702
Prince Edward Island	279	.....	1,995	2,274	87,000	26.0	3,000	5,300	2,274
Yukon and North West Territory	10,000	.....	3,199	13,199	12,000	1,100.0	125,200	275,300	13,199
Canada	4,012,428	526,731	344,107	4,883,266	9,519,000	513.0	20,197,000	33,113,200	4,883,266

Column 2 includes only hydro-electric stations which develop power for sale.

Column 3 includes only water power *actually developed* by pulp and paper companies. In addition to this total, pulp and paper companies purchase from the hydro-power central stations totaled in Column 2 horsepower estimated at about 831,000, making a total of about 1,358,000 hp. actually used in the manufacture of pulp and paper.

Column 4 includes only water power *actually developed* in connection with industries other than the central-station and pulp and paper industries. These industries also purchase blocks of power from the central stations which are totaled in Column 2.

Column 5 totals all turbines and waterwheels installed in Canada.

Column 6 lists the population as of June 1, 1927, according to estimates made by the Dominion Bureau of Statistics.

Column 7 averages the developed water power per 1,000 population.

Switch-Structure Equipment Schedules

A logically and carefully arranged system of preparing drawings saves time and results in more valuable records

By W. F. Sutherland
Toronto Hydro-Electric System

SHOWING of structural details and equipment ratings on the same drawing is open to objections from many standpoints: Confusion frequently results from the admixture of electrical and mechanical features, particularly when structures are built by contractors. Revisions are difficult. Complete information cannot always be provided, owing to insufficient space. After a few years, office records are apt to become obsolete and of little value for accurate reference as to constructional conditions in the station.

With the practice now followed by the Toronto Hydro-Electric System, a complete inventory of electrical equipment is always available, down to the nuts and bolts used for fixing the various component details. Records are always up to date. Drawings can be revised for the installation of an additional feeder in a few hours, instead of several days.

Three separate types of drawing are now issued: (a) Construction drawings for the building of structures; (b) diagrammatic equipment cross-sections; and (c) electrical equipment schedules.

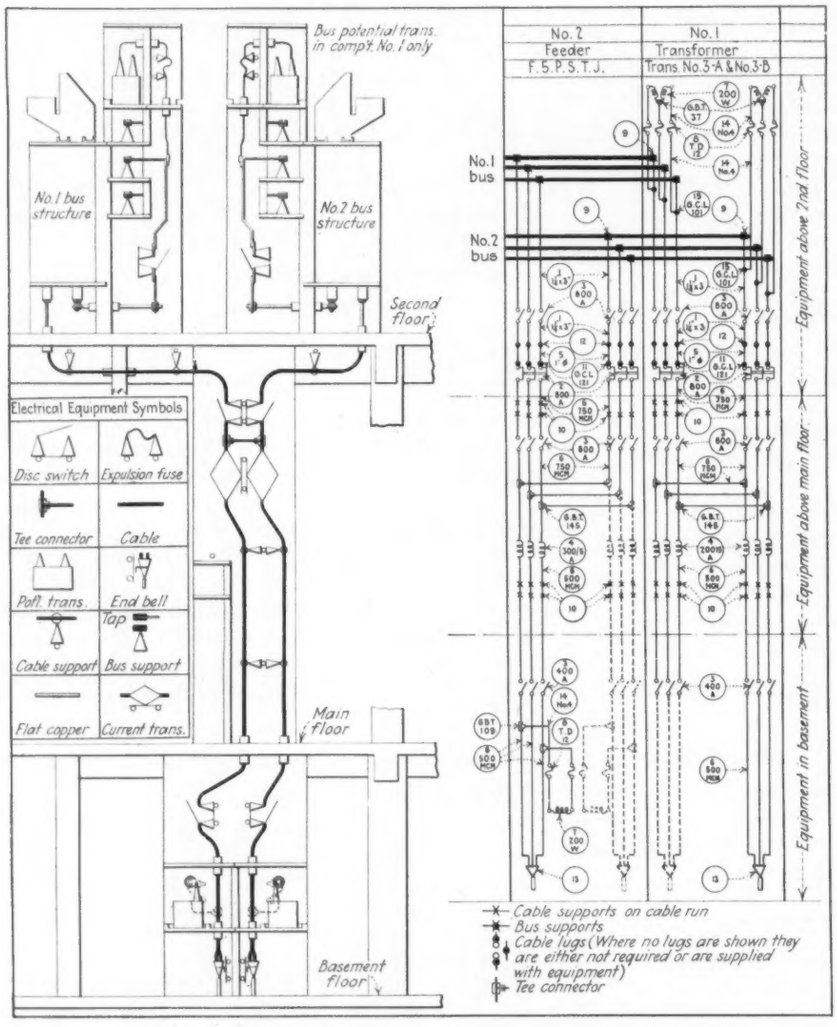
(a) The construction drawings for structures follow standard practice, generally speaking. All details and dimensions necessary for the building of the purely mechanical portions of the structures are given. Conduit is shown on these and the main ground buses are also called for, detail grounding being left to the man on the job, who follows standard practice.

(b) The diagrammatic equipment cross-sections (Fig. 1) show the structure to scale and also the electrical equipment, approximately to scale, in the location intended for it. A separate cross-section is drawn for each type of compartment, feeder, transformer or otherwise, where these differ markedly in detail, and where differences cannot be dealt with satisfactorily by notes. No dimensions are shown, nor is any information given concerning the size of apparatus or type. The drawing is merely a picture, nothing else.

Disconnecting switches, current transformers, etc., are indicated with as little detail as possible, and thus become symbols for the actual equipment. Owing to the absence of detail information, these equipment cross-sections are quite general in their application, and thus one cross-section may readily represent all the feeders in a station irrespective of size of cables, current transformers, or other details subject to variation.

Elevations of compartments have been found of little use, and, in general, have been omitted, the cross-section usually giving all information required for the arrangement of apparatus in the structures.

(c) The electrical equipment schedule (Figs. 2 and 3) is important, for on it is given all the information as to what compartments are equipped, the apparatus used and its capacity. The drawing showing actual circuits and equipment rating (Fig. 2) is ruled off in vertical divisions, each representing one complete compartment. The individual cell or compartment numbers, which also appear on the structure drawing, are given at the top of each compartment. Below these appear the types of service to which the compartments are allocated, and, in a third line, the equipment designations, feeder or transformer numbers appear. Horizontal lines divide the vertical divi-



Figs. 1 and 2—Physical arrangement of equipment shown in separate drawings from circuits and apparatus ratings

The physical arrangement only, and not equipment, size or capacity, is shown at the left. The size, capacity and kind of equipment, but not the physical arrangement, are shown at the right.

Special symbols have been used where necessary on this drawing to cover apparatus not usually shown on wiring diagrams; otherwise the notation is standard. Equipment is the same on all three phases unless otherwise shown. All equipment to be installed is shown in full. Reference numbers applying to equipment in this structure are shown in the upper half of each circle. Information regarding size or capacity of equipment is given in description column opposite corresponding number in table of Fig. 3 or in lower half of circle. Where nothing is stated in the "Required for Mounting" column, mounting equipment is either not required or is supplied with the apparatus. One set of lugs on each set of switches is to be painted the respective phase colors.

REF No.	DESCRIPTION	REQUIRED FOR MOUNTING	REMARKS
1	¼"x3" medium hard drawn flat copper		Number of bars shown thus (2-¼"x3") (1-¼"x3")
2	C.G.E. 800A. 25,000V. T.P.S.T. type H203 oil circuit breaker		
3	Powerlite 15,000V. S.P.S.T. disconnecting switches		Size shown thus (3 800 A) (3 400 A)
4	Packard Elec' 15,000V. type T.H.-15 current trans.' Dwg No. 4872	2-P.F.-35, 4-G.U.-2, 4-½"x1½" machine bolts	Size shown thus (4 300/5 A) (4 200/5 A)
5	1"diam. round copper rod as per detail P.R.C.-1	4-P.H.B.-1, 1-G.C.L.-121	
6	13,200V V.C.I cable		Size shown thus (3 150 MCM) (3 500 MCM)
7	Packard Elec.' 13,200/110V. 200W. 25~ potential trans. Dwg. No. 4871		
8	C.G.E. 13,200V. type T.D.-12 expulsion fuses & support & holders. 1¼"pipe M't'g.		
9	Powerlite 15,000V. bus supports	4-½"x2½" machine bolts	
10	Powerlite 15,000V. cable supports 1¼"pipe M't'g.		
11	G.C.L.-121 cast copper lugs Dwg. No. 5255		Hole "A" drilled 15/16" Hole "B" " & tapped for 1" bolt
12	P.H.B.-1, 1"hex. brass nuts ½"thick		
13	St'd underground 3 cond. round upright end-bells 16,000V. 350 M.C.M. No. 238,965	1-S.U. end bell bracket No. 9, 1-P.F.-36, 2-G.U.-12, 2-⅜"x1½" mach. bolts	
14	13,200V. No. 4 V.C.I. hard drawn wire		
15	G.C.L-101 cast copper lugs Dwg. No. 5255	1-⅜"x1½" H.H. cap screws, ⅜" hex nuts, 1-⅜" lockwasher, 1-⅜" W.I. washer	
16	C.G.E. 13,200/110V. 200W. 25~ type C.Q-1 form P. Potential trans.		

FIG. 3—EQUIPMENT IN THIS FORM IS INCLUDED ON DRAWINGS LIKE FIG. 2

sions into sections corresponding to station floors. Three lines not shown in Fig. 2 are reserved at the bottom for further reference notes, the bottom one carrying a designating letter corresponding to the section designations.

A complete wiring diagram is drawn, showing all apparatus in one typical compartment of each kind, the others being left blank except for notes calling for equipment similar to the typical compartments. If a compartment has no equipment, it is, of course, left blank. Each item is given a designation seen in the upper halves of the circles; the lower halves are reserved for size, in the case of copper and cables, or capacity in amperes for disconnecting switches, etc. The designation refer to a table on the same drawing, but shown separately here, in which complete details, except for size or capacity, are given. Only capacities or sizes appear on the diagram in most cases, not in the table, thus avoiding a multiplicity of references.

As arranged, the schedule provides a means of recording all essential information in a most convenient form. It is a wiring diagram, a means for installing the equipment, and a permanent record of all that has been installed. The arrangement has proved most successful on the Toronto Hydro-Electric System both in office and field.

Remote Starting of Fire Pump

By D. F. Richardson
General Electric Company, New York City

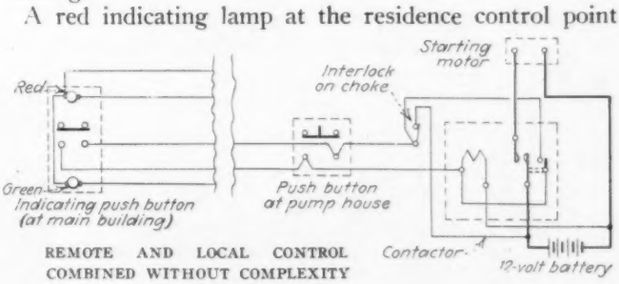
Recently the owner of a large country estate installed a gasoline-engine-driven centrifugal pump in a pump house remote from his home for the purpose of fire protection. It was desired to provide a simple method of remote starting, parallel to the control in the pump house, by means of which the pump could be started in either place.

The engine is started by an electric motor, power for which is supplied by a 12-volt storage battery. A contactor was installed in the pump house and its pilot circuit was wired for push-button control from either the pump house or the owner's residence, with indicating lamps at the latter point. The 12-volt battery circuit is also used for the pilot circuit.

Pressing the button at either point energizes the holding coil in the contactor and closes the motor circuit, starting the motor. A second set of contacts mechanically connected to the contactor shaft closes simultaneously with the motor circuit contacts and thus maintains the circuit to the holding coil after the pilot circuit is opened upon removal of pressure on the push button.

As soon as the engine starts firing a plunger attached to a piston in a small cylinder rises by oil pressure. This opens the engine choke and also opens a contact in the holding coil circuit, breaking the motor circuit and thus disconnecting the starting motor. This is particularly necessary as the engine runs faster when firing than when driven by the starting motor. This plunger-operated contact, when once opened by the operation of the engine, also prevents restarting the motor when the engine is running.

A red indicating lamp at the residence control point is wired in parallel with the motor terminals, and indication is thus given by the lighting of this lamp when the motor is started, the lamp remaining lit as long as the motor is running. When the engine starts firing and the motor is de-energized the lamp, of course, goes out. A pressure switch in the discharge line of the pump closes when water pressure is built up, thus completing a circuit to a green lamp which lights and indicates that the pump is operating satisfactorily.



REMOTE AND LOCAL CONTROL COMBINED WITHOUT COMPLEXITY

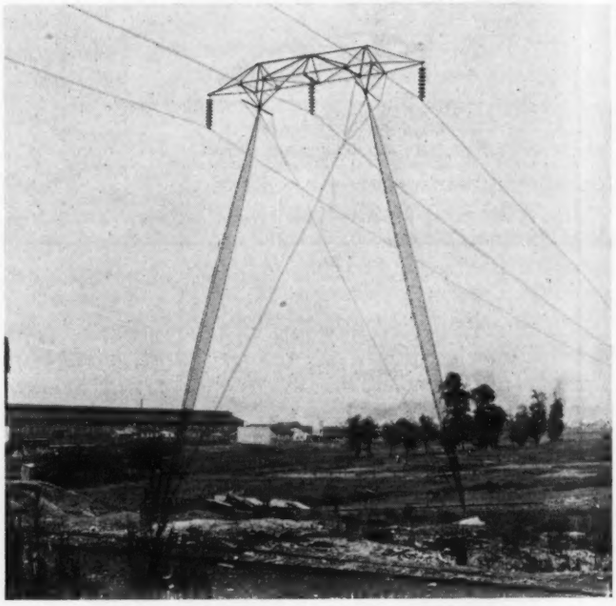
Declares Selfishness Is an Evil of American Industry

SELFISHNESS is the greatest underlying evil that American industry is up against today and it is sapping the life out of practically all competitive lines, according to Charles J. Graham, president of the Bolt, Nut and Rivet Manufacturers' Association, Pittsburgh, in speaking before the Pennsylvania State Chamber of Commerce at Harrisburg, Pa., recently. In discussing the change in the bolt, nut and rivet industry, when from a high loss of $12,000,000 in 1924 the industry made a profit of approximately $6,000,000 per year in 1925, 1926 and 1927 on an invested capital of about $150,000,000, Mr. Graham said: "We found that we were conducting our individual companies on a basis that had lost all semblance of decency or fairness—fairness to ourselves, our competitors, our customers or to the world at large. We have entirely revolutionized our business methods. We have dug in deep and brought to the surface all of the evils we could find and have killed them one by one. We have developed a degree of unselfishness never before attained either in our industry or any other we know anything about.

"What has been the result other than a return in dollars? We can look the world in the face today with a degree of pride, our competitors are our friends rather than our enemies and we are conducting our business on a higher ethical plane than ever before and have created the same honest conduct in our business as heretofore ruled in our social lives. We have gone further than this. We have started a movement which we feel has solved the distribution problem in our own industry, and if the same plan is followed by all other industries it will be the greatest automatic stabilizer of business and labor conditions of anything heretofore attempted. Our distribution plan is very simple but very effective. We have been brought to realize the importance of the jobber in the proper and economical distribution of our merchandise.

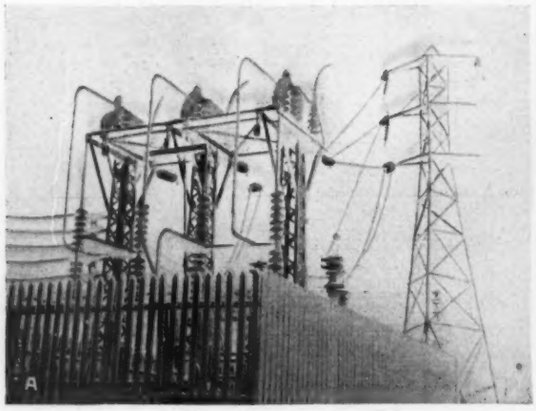
"During the period of ruthless competition which culminated in our financial distress of 1924 we had ignored the existence of the jobber and became his chief competitor, thereby creating in him an enemy and becoming the chief aggressor in the rapid decline of our markets, brought about entirely by our lack of appreciation of his importance to us. This recent move of ours, in creating the proper channels of distribution of our products, is the greatest we have ever made in cost reduction. It will mean a marked reduction in our sales expense, and will also go completely through the organization, beginning where actual manufacturing stops—shipping expense, packing expense, clerk hire, accounting, stationery and office supplies—and such savings eventually will react to the benefit of the ultimate consumer."

French Claim Many Advantages for New Towers



AN EXPERIMENTAL line has been placed in operation using articulated towers of unusual design, according to a correspondent in France. Among the advantages claimed are extreme lightness, greatly reduced foundation requirements, long spans, high resistance to transverse stresses, great adaptability to local conditions, unimpaired strength under conditions of conductor breakage and ensuing unbalanced forces and economies of construction and maintenance.

Operators of These Stations Work Under Difficulties in Winter



(A) SLEET STORM GRIPS STATION OF THE CONSUMERS' POWER COMPANY. (B) HEAVY SNOWFALLS ADD TO THE BURDEN OF OPERATING MEN IN SUBSTATION OF THE BUFFALO, NIAGARA & EASTERN POWER COMPANY

Holding Company Upheld*

Parent organizations evolve naturally. Have made possible tremendous growth and immeasurable economies. Objections discussed

By Col. George T. Buckingham
Vice-President Illinois Power & Light Corporation

THE term "holding company" is a very loose and ill-defined term. It describes a great number of different things. In its broad sense it is a corporation which holds the stock of another corporation. In that sense fully 20 per cent of all existing corporations are holding companies. Banks, trust companies, insurance companies, investment trusts, personal family corporations and the like are as numerous as the sands of the sea, and all of them are holding companies.

But the term has come to have more limited meaning in financial circles, where it indicates in a general way a "parent company," one that not only holds the stock of operating corporations but exercises some degree of supervision over their operations. In the year 1924 one-fifth of all corporate dividends paid out by corporations in the United States was paid to other corporations which were the stockholders. This would indicate that one out of five of all corporations is to some degree a "holding company."

Developed From Small Beginning

In December, 1926, the output of current was more than 7,000,000,000 kw.-hr. That was considerably more than the output for the entire year 1903. On statistics the size of the industry has been multiplied by twelve in twenty years. In 1903 and theretofore the electrical industry consisted for the most part of single plants operating in a single town. The plant was a small affair; 250 kw. was a good big unit of generation; 500 kw. was a big plant. That plant furnished what lighting was required for that small community. The radius over which it could distribute energy was a few miles. The cost of production in these primitive plants was such that it did not occur to anybody to use electric current for power.

But as years went by the art developed with a rapidity and momentum never before known. Larger generating units constantly became the standard installation, and corresponding improvements in transmission were perfected at the same time, so that now, in the most recent study made by the Bureau of Commerce in the New England district, it is reported that the most economical plant for producing electricity is a plant of 200,000 to 300,000 kw.-hr. capacity; that no single generator smaller than 20,000 kw. capacity can economically be installed, and that the high-tension trunk lines, which had jumped up from 8,000 to 16,000 to 32,000 to 64,000, should be of 132,000 voltage capacity. Even now throughout the Middle West electric energy is generated in these huge central plants and transmitted over spider web tentacles hundreds of miles in every direction, so that one single central plant serves, not only for lighting but also power, literally scores of communities. Now, this rapid development of the industry necessitated huge capital investments and great corporate organizations, and so throughout the years a number of operating electrical companies have steadily decreased by consolidations and the size of the operating corporations have steadily increased.

Obviously, the machinery set up for that control, methods of accounting, methods of appraisement, local laws, etc., of the various states are different, and therefore the tendency is that every operating corporation in the electrical field should operate in a single state. Not only that, but in some states, such as Illinois, utility properties cannot be operated except by an Illinois corporation. If, therefore, a Delaware or any other foreign corporation desired to own property and conduct operations in, say, Illinois, Missouri and Kansas, the naturally indicated program would be to set up a parent company, which holds the control of separate operating companies, one or more in each state.

By this natural process the holding company came into being, and it is these holding companies whose securities are distributed to the public, and in the ownership of which thousands of people participate. Having traced briefly the genesis and evolution of the holding company, we may also consider briefly some of the objections that are urged against them in some quarters and that are the basis of inquiry here and there, even in some high quarters.

Some Objections That Are Raised

The first of these is that these huge holding corporations are interlocked and either are or tend to a unified single monopoly. That objection has recently been dispelled by two successive reports of the Federal Trade Commission, which put in about two years investigating it at the request of the United States Senate. That report showed that the largest of all the holding groups, Electric Bond & Share, is in some way related to an aggregate output of 10 per cent of the total in the country. The next largest single aggregation, the Insull group, is 8.7 per cent of the total. The North American Company is next with 7.1 per cent of the total. There are many others, but none of them, not even the great Byllesby organization, exceeds 4 per cent of the total. So the Federal Trade Commission reported that there is nothing that approximates a monopoly and that no such thing is possible.

The next objection which has been urged, notably by Senator Walsh, is that the great holding companies have been selling to the public enormous quantities of their

*From an address before the Electric Association of Chicago.

securities and that the amount of these new securities put out in the last few years has greatly exceeded the value of the actual improvements and extensions that have been made. A committee of lawyers recently sent out a questionnaire to all the great holding companies inquiring what securities they and their subsidiaries had outstanding in the hands of the public, eliminating, of course, intercompany holdings, and, on the other side of the ledger, upon what actual assets these securities were based. Now, have in mind that the securities which the holding companies hold are for the most part the stocks of operating companies. These can be issued and get into existence only when approved by the commissions of the various states, as based upon adequate actual assets. In other words, the assets of the holding companies on their books are more closely appraised and approved in point of valuation than those of any other holding companies in existence.

The first 24 companies that reported these data (these were not selected but simply were the first ones that came in) were then tabulated. These 24 companies were representative and typical holding companies, representing in the aggregate 43.5 per cent of the whole output of the United States. The figures disclosed that in the years 1920 to 1926, inclusive, the ratio of actual investment assets to total outstanding capitalization varied from 110 per cent to 118 per cent. This is a showing which I believe cannot be duplicated by any group of holding companies in any other field.

Furthermore, there appeared before the Senate committee outstanding economists, state officials concerned with the administration of the state laws, officials of insurance companies and investment bankers. These people bore witness that, because of the rigid state regulation of the issuance of securities on the part of operating companies, the careful scrutiny and analysis that is given all these issues by the great banking houses, the tremendous publicity given to their operations, the securities of the great holding companies in the electric field are considered by investors to be at the very top in point of desirability and soundness. No security issue of any major holding company in the electric field has defaulted in years.

Pyramiding of Control

Another objection that has been raised to the holding company is what Professor Ripley calls their "pyramiding of control." He says, in effect, that a holding company holds the controlling stock of a number of operating companies. The holding company itself has outstanding preferred stock which does not vote. Its common stock, or a majority of it, having voting rights, is held within the control of a small group of people, who are the leading spirits in the enterprise. This, he says, is wrong; that all stock, common or preferred, should have, but does not have, a vote; that it is a vicious thing for a comparatively small percentage of the stock to control a great corporation.

With the professor on this basic, economic question I take direct issue, both in fact and in theory. I affirm that his statement of fact is erroneous. In many of the leading holding companies, if not most of them, all shares of stock have a vote. Indeed, in some states, like Illinois, for instance, all shares must have a vote.

And I also affirm that in principle it is not of the slightest consequence whether all of the stock of a great holding company held by the public votes or whether it does not. The result is exactly the same. Swift & Company, by way of illustration, a great corporation not in the utility field, has only one class of stock and all of it votes. The Swift family has managed the corporation for many years and holds only a minor fraction of that stock. The stockholders, without exception, and practically unanimously, send their proxies to the managing people in favor of retaining the management in its place.

There are many other minor questions which have been raised as to the operation of holding companies. Time is too short to review them all. We have considered the major ones, but it is my belief that the great holding company of the present day is just as much a necessity of the modern industrial era as is the locomotive, the super-power house and the giant transmission line. These things all go together of economic necessity, and they all develop along parallel lines.

Work of Promoters Not Typical

Parenthetically, it may be said that there are certain companies, evolved by promoters rather than by constructors, which fall outside these generalizations. There are sporadic instances of inflated capitalization in the public utility field, exactly as there are in other fields, but they are not typical, are not numerous and, in size, are relatively unimportant. What shortcomings and misdeeds are to be laid at their door are not fairly attributable to holding companies generally. Disregarding this very insignificant minority, the achievements and the benefits of the great holding companies in the electric field may be fairly summarized thus:

They have brought to every city, to most hamlets and within striking distance of most farms a reservoir of power—power which is the cornerstone of civilization—in quantity never before dreamed of.

They have made this power reliable and dependable, so that users everywhere, large and small, may with confidence base their operations on a constant, as well as a limitless, supply.

By the economies of financing, manufacture, organization and operation, inherent in their great operations, they have made power available to the user at low cost.

This is practically the only product, commodity or service now sold to the public at prices lower than pre-war and while all other prices have been upward.

By the wide sale and distribution of their securities they have brought millions of citizens into the ownership of the utilities which serve them. They have done more to "peopleize" industry and thus to combat socialism than all other agencies combined.

Their properties are owned by more people than any other group of properties in the world. Their securities have a record of safety of principal and continuity of interest and dividends not even approximated by the record of any other industry.

This, then, is a résumé, abbreviated and inadequate, of the record of the great holding companies in the public utility field. Collectively they may, without fear, challenge comparison with the record of any other group.

Their operations have been conducted in broad daylight, with the utmost publicity to their millions of customers and to their millions of security holders.

When the amazing history of the twentieth century comes to be written—the century of super-power—and of the prosperity that follows in its train, the achievements of the great holding companies and their developers will be remembered by the millions to whose well-being and prosperity they have contributed so materially.

Appliance Repairs— A Profitable Utility Service

By H. W. Ewald
General Sales Department Duquesne Light Company, Pittsburgh, Pa.

BROKEN APPLIANCES in customers' homes bring no return to the central station and represent an investment loss on the part of the purchaser. By helping our customers to get their electrical devices repaired, we not only add load to our lines, but we increase the public's confidence in things electrical and pave the way for the selling of new appliances.

The Duquesne Light Company has a special department equipped for repairing all electrical appliances used in the home. Our customers are invited to leave their depreciated equipment at any one of our thirteen gas and electric shops. From these stores they are sent to the appliance repair department. It matters not where the device was originally purchased, we are glad to repair it, if it is worth fixing, and the cost of this service to the customers is very reasonable. We aim to give prompt service, and, in many cases, the appliances are repaired within twenty-four hours.

It often happens that a device has to be taken apart before one can tell if it is worth repairing; if it is not, the customer is notified, as a rule by telephone. In this way, the customer can decide upon the desirability of extensive repairs or the purchase of a new appliance.

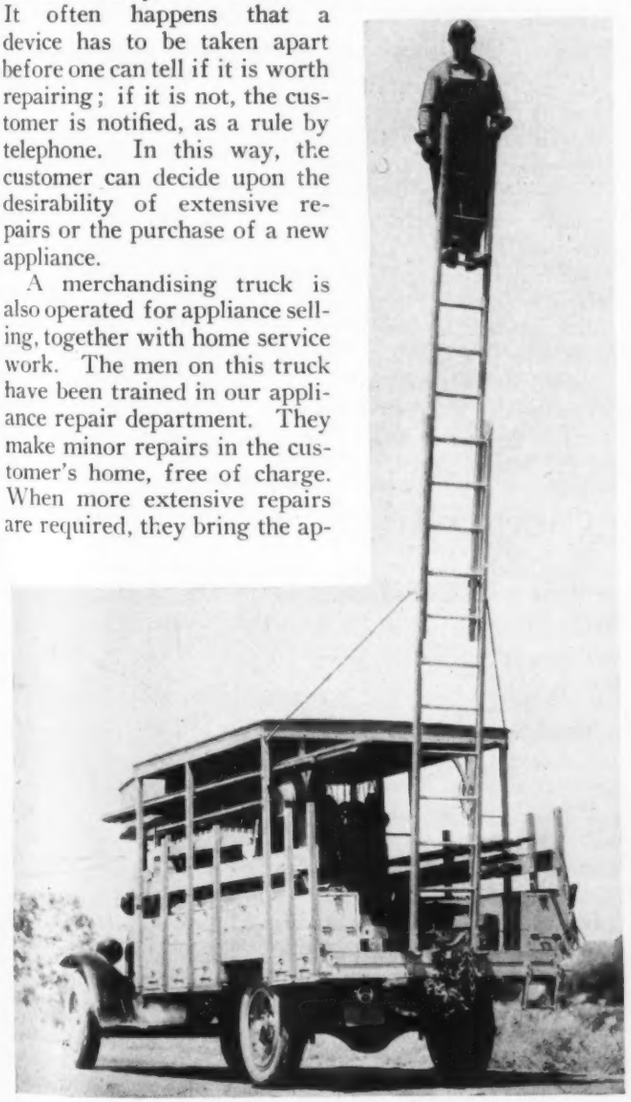
A merchandising truck is also operated for appliance selling, together with home service work. The men on this truck have been trained in our appliance repair department. They make minor repairs in the customer's home, free of charge. When more extensive repairs are required, they bring the apparatus into our shop and later return it to the customer ready for service.

Several years ago the policy of exchanging new iron cords for old ones, free of charge, was inaugurated. From that time until now, this service has grown steadily. We are replacing about 15,000 iron cords a year. No charge is made, except in those cases where the terminals of the cord are damaged. Many appliances are put on the shelf because the cords are damaged, but, as a rule, the customer thinks the fault is more serious.

We have had special iron cord boxes manufactured for our free cord service. Attractive ads appear on the sides of the box telling the high points of this service. Rubber stamps are used to mark each box with the kind of cord that is inclosed in order to assure correct exchanges. Special gummed labels, carrying announcements of our repair service, are used to paste on the special boxes containing the repaired devices and greatly assist us in returning the appliances in good order.

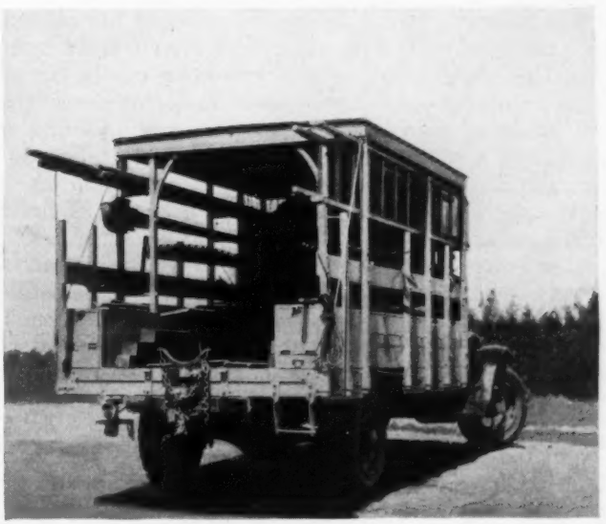
The repair department also serves the function of a laboratory for testing new appliances put on the market from time to time. The shop is fully equipped with modern machinery and special tools, together with a personnel of experienced mechanics. A complete stock of parts for all makes of recognized standard appliances is kept on hand.

In the opinion of the writer, the building of residential load is only begun when we sell the appliance. The next step is to teach the customer to use it to the fullest extent. The third, and by no means the least important step, is to see that the appliance is kept in repair.



Time- and Labor-Saving Features in Line Truck

SPECIAL features of two line trucks used by the Idaho Power Company which make for time and labor economy and convenience are plenty of handy bins for tools, etc., a body which is only 35 in. above the ground and an extension ladder which may be quickly mounted on the rear of the truck. The ladder is supported by hinges and is held in the working position by the two brace rods shown. The ladder is especially useful in trimming trees and in many cases is used in stringing wire and maintaining lines.



EXTENSION LADDER ADDS TO USEFULNESS OF LINE TRUCK

A Banker's View of the Electric Refrigeration Industry

Situation in the industry such there is little fear of competition. Financial backing for new enterprise would be extremely hard to obtain

By F. J. Fuller
Vice-President Central Union Trust Company

ELECTRIC refrigeration has been in the process of intensive development during the last five years and has met with all of the vicissitudes which a new industry should expect to encounter. Difficult patent situations have had to be worked out and in all probability additional adjustments and litigation of patent rights will be necessary in the future. Large capital expenditures have been made for plant facilities, equipment, inventory, experimental work and the establishment of sales organizations. This capital was, for the most part, obtained by the sale of stock to an enthusiastic public under very favorable market conditions. In some instances bonds and other fixed obligations were issued and a fairly wide distribution of the refrigerating-company securities was obtained.

As is usual in the case of a more or less novel product, the electric refrigerator has, in many directions, had a popular appeal, stimulated by costly advertising and other high-pressure methods of publicity. In the early stages of the development the demand outstripped the supply and many companies, lured by the possibilities of large profits, entered the field, each offering an article for which it claimed superiority by reason of improved patents, greater efficiency in operation, simplicity in construction, and so forth.

In the efforts to get into production on a large scale, many of the companies in the industry suffered severely from mistakes in engineering, errors in design and mechanical defects. Overhead in all departments increased enormously, economy in operation was lacking and, despite a large volume of business, the capital investment showed little, if any, return in far too many instances.

With the distribution of the product, servicing problems were encountered, and the result of hasty manufacture, both of machines and of boxes, began to tell. Dissatisfaction spread among the users of the machines and the good will of the companies was, to some extent, impaired. The resulting sales resistance can be successfully combated only if the manufacturer offers a "quality product," provides adequate servicing facilities and maintains a selling organization thoroughly equipped to educate an unconvinced but expectant public in the advantage, convenience and even the necessity of electric refrigeration.

The situation in the industry is so well and generally known that there should be little fear of competition from new enterprises for some time to come. Assuming that the inventor or promoter has the temerity to seek entrance into a field that is so thoroughly covered, he will, undoubtedly, find it quite impossible to obtain the requisite financial backing.

On the whole, the securities of the companies in the industry have proved a distinct disappointment, and substantial losses have been suffered by their holders, justifying the attitude of the investment banker and his public to look askance at the securities of new electric refrigerating companies, which have to go through the lengthy and discouraging processes of organization, experimentation and development with their attendant uncertainties and disappointments.

A great deal has been accomplished during the recent months toward the stabilization of the industry, but the field is highly competitive and few companies have the financial resources with which to carry out the program indicated. Satisfactory results will be slow in forthcoming, but an efficient and careful management, with adequate working capital, building cautiously from a solid foundation, with a view to development and expansion in a conservative way, can look with confidence to the future. It will virtually be a case of the survival of the fittest.

Five Recommendations Made to the Refrigeration Industry

A REFRIGERATOR manufacturer believing that the industry will not prosper until something has been done to stabilize it offers the following five recommendations:

1. Some organization corresponding to the Society of Automotive Engineers (S.A.E.) is needed in order to stabilize and standardize engineering.

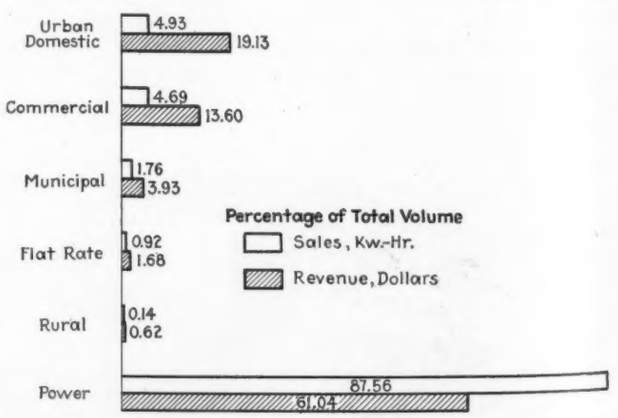
2. To stop constant bickerings between the major companies as regards infringement some solution along the line of cross-licensing of patents should be worked out.

3. There should be a curtailment of unwarranted advertising claims, which are detrimental to the industry as a whole.

4. Price cutting should be stopped and prices stabilized so that every one in the industry, who is entitled to do so, can get a fair return on the money invested.

5. The ethics to be followed by salesmen should be laid down by the executives of the company and "knocking" of a competitor's product should not be resorted to as often has been done in the past.

Customer-Revenue Values Compared



AN ANALYSIS of customer classifications and resulting revenues has been prepared by E. H. Jenness of the Ohio Public Service Company, Elyria, Ohio. The records of this utility indicate that the factors are distributed as shown above.

Southern Pine and Creosoting*

Opinions of pole users. Data on cost of poles. Methods of inspection and purchase. Life of poles in Southern territories

By L. W. W. Morrow
Managing Editor Electrical World

In A survey of opinions in all sections and after talking with both producers and users of creosoted poles the writer gained some general impressions and facts which are presented for constructive purposes. A very important part of the job involves the timber before treatment. Careful inspection in the woods should be followed by an immediate shipment to the storage yards or to the treating plant. The green timber decays rapidly if left lying on the ground or if subjected to moisture. Upon arrival at a treating plant the timber, if stored, should be watched carefully and treated when seasoned sufficiently. If proper precautions are taken in these matters, it makes little difference whether the timber is cut in winter or in summer. Winter-cut timber is less apt to be affected by decay or checking during the seasoning process, but it is difficult to peel the inner bark. Summer-cut timber peels readily but is more apt to weather check during seasoning.

If time is available for air seasoning, less creosote is needed in the treatment and therefore the product is more satisfactory from the standpoint of immediate use after treatment, because leaching is less. Buyers of poles, ties and structural timber, however, usually wish immediate deliveries, and the creosoting companies find it uneconomical to fill their yards with timber that may or may not satisfy the various purchasers' requirements. When air seasoning is complete, the creosoted treatment of 4 lb. per cubic foot must be given and the material then stored again in the yards until purchase is made, when a further treatment is necessary. This practice involves double handling and added costs. Thus the long time required for air seasoning places a time premium on using an immediate treatment of green timber. This requires about sixteen hours at a modern plant.

Storage Prior to Shipping Reduces Leaching

Another aspect of the situation involves the practice of immediate shipment after treatment. The poles are covered with creosote oil and are subject to some surface leaching, and thus are inconvenient to handle, but if the treated poles are stored for a short time, practically all leaching ceases and dry and more conveniently handled material is available for use. Some telephone and railroad companies specify storage after treatment as part of their practice in using creosoted material.

Another element is that buying habits and market demands are not adjusted for best results. The pole producer is compelled to cut, treat and ship the poles quickly to meet a construction program that is almost contemporaneous with the purchasing program of the utility.

Personal observation leads to the belief that a better understanding of the creosoting business on the part of purchasers would help greatly in smoothing out the production programs of the creosoting companies and at the same time insure to the purchasers a uniformly good product.

Rigid inspections by utilities are difficult to institute in many cases and the best protection for small purchasers is to buy from creosoting companies of established reputation. Any creosoting company that expects to remain in business must develop a method of inspection and treatment that will insure the production of a uniformly good product.

Service Experience and Opinions of Four Utilities

Service experience with creosoted timber may be had in many sections of this country, and a typical cross-section of comment is given in the following excerpts:

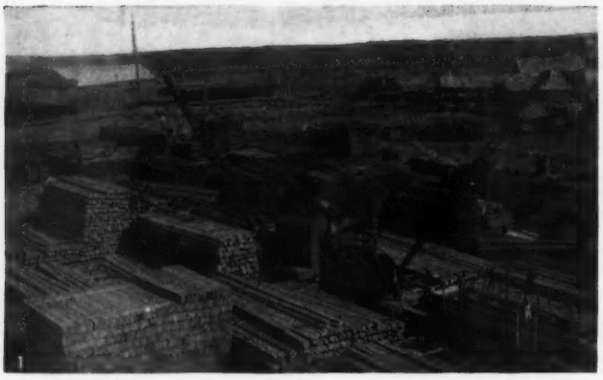
Utility A.—We have standardized on creosoted poles for all service from secondary distribution to 110-kv. transmission lines. The replacements are from 1½ to 2 per cent for the first six or seven years, after which they cease until about the fifteenth year, when some poles start to decay. The first replacements result from the use of poor timber or from improper treatments. The life of a good and properly treated pole we find is from 25 to 30 years. Our linemen have no criticism of these poles as regards working on them.

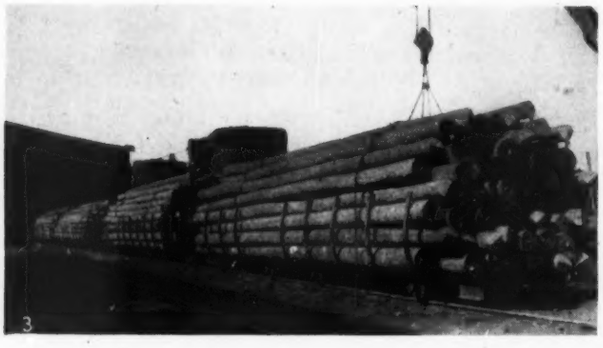
Utility B.—We are using creosoted poles entirely now and have over 40,000 of these poles on our system. We find creosoted poles very satisfactory and their life is at least twenty years. In very hot weather the linemen take some precautions in working on these poles because of their conductivity. The men who object to working on the poles at first are linemen from the North or East who have had no experience with creosoted timber.

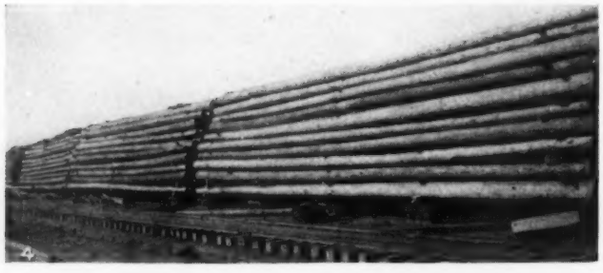
Utility C.—As a result of various investigations we have standardized on the use of creosoted poles. These are purchased on strict specifications so far as mechanical defects are concerned. They must be thoroughly seasoned and then are given a 10-lb. treatment. This treatment penetrates to a depth of from 3 to 4 in. from the surface. Our poles with this treatment give an average life of about 25 years.

Utility D.—The use of creosoted poles on a 44-kv. line on this system dates back to 1907. These poles are now standard with us on all 44-kv. and 110-kv. lines and have been recently adopted for 2,300-volt lines and secondary distribution in towns and cities. We have had time to form a true estimate of the two elements often mentioned as disadvantages of creosoted poles—

*Conclusion of article started in Feb. 18 issue.







Handling, framing, inspecting and seasoning of poles preparatory to treatment

1. Incoming poles being unloaded in the yards of one large creosoting company.
2. Framing and inspecting poles in the yard before treatment.
3. Trams loaded with poles and entering the treating retort.
4. Poles stored in the yards for air seasoning.
5. Ties stored in the yards for air seasoning.

TABLE I—NUMBER, UNIT COST AND LIFE OF POLES IN SOUTHEASTERN AREA*

Kind of Pole	Number	Unit Cost in Yard	Unit Cost in Place	Life in Years	Treatment
Chestnut	207,253	$6.64	$11.20	9	Practically none, a few brushed carbolineum
Cypress	35,700	8.20	11.20	12	Practically none, a few brushed carbolineum
Western red cedar	16,033	17.60	21.10	11½	¾-in. and ½-in. Pentrex
Native red cedar	14,673	11.40	16.20	21½	None
Creosoted pine	143,171	14.92	20.30	23	8, 10, 12-lb. empty cell and 10, 12-lb. full cell
Juniper	46,282	6.83	10.96	9	None, a few brushed carbolineum

* Southeastern Section N.E.L.A. overhead systems committee, Memphis, 1927.

TABLE II—RANGE IN POLE PRICES OF SIX KINDS OF POLES USED IN THE SOUTH*

Kind of Pole	Price, f.o.b. Yard— Low	High	Average	Price in Place— Low	High	Average	Cost of Installation, Average
Chestnut	$4.25	$12.75	$6.64	$7.00	$14.75	$11.20	$4.56
Cypress	5.00	17.00	8.20	7.00	18.00	11.20	3.00
Western red cedar	13.85	25.00	17.60	19.10	35.00	21.10	3.50
Native red cedar	7.50	15.30	11.40	12.50	19.90	16.20	4.80
Creosoted pine	11.00	25.00	14.92	14.87	32.50	20.30	5.38
Juniper	5.00	8.00	6.83	9.15	12.95	10.96	4.13

* Overhead systems committee, Southeastern Section, N.E.L.A., 1927

TABLE III—LIFE OF SAME KIND OF POLES IN THE SOUTHEAST*

Kind of Pole	Minimum Age, Years	Maximum Age, Years	Average Age, Years	Treatment
Chestnut	3	15	9	None
Cypress	6	20	12	None
Western red cedar	8	20	11½	Butt
Native red cedar	18	25	21½	None
Creosoted pine	17	40	23	8, 10-lb. empty cell
Juniper	7	10	9	None

*Overhead systems committee, Southeastern Section, N.E.L.A., 1927

that is, conductivity and leaching. These factors receive practically no consideration now and are regarded as of very minor importance compared with the advantages resulting from the use of creosoted poles. We use a 10-lb. treatment.

Many other utilities, railroad and telephone companies can be quoted in about the same words and these purchasers continue to use and to buy creosoted products. Their major consideration has been the purchase of poles that satisfy service conditions, delivery conditions and that are available on a competitive basis in the pole market.

N.E.L.A. Committee Reports Practices of Twenty Southeast Companies

In a recent survey of the overhead systems committee of the Southeastern Section of the N.E.L.A. some interesting data on the use of poles in that region were compiled. These data are given in Table I. It may be noted that of the 463,112 poles reported in this 1927 report the following percentages exist:

Chestnut, 45.
Cypress, 7.7.
Western red cedar, 3.4.
Native red cedar, 3.1.
Creosoted pine, 31.0.
Juniper, 9.8.

Of the twenty utilities reporting, twelve used chestnut poles, eight cypress, two native red cedar, nine Western red cedar, fifteen creosoted pine and three juniper. The utilities which used chestnut poles were in the mountain section of the region and those using cypress poles were in the tidewater region. The native

timber is thus used in local markets. Several companies in the territory which is covered by the Southeastern Section of the N.E.L.A. have discontinued the use of chestnut and Western red cedar poles for no announced reason and there is a marked trend toward a greater use of creosoted pine poles because of long life and great strength.

In Table I the average cost was based on a 35-ft. pole with 7-in. top, but the range in prices as given by the utilities show data which give an interesting bearing on commercial conditions in the pole industry in the South. These data are given in Table II. The life of poles depends upon many factors, but Table III gives the data on Southern utility experiences as compiled by the overhead systems committee of the Southeastern Section of N.E.L.A. The native red cedar shows a remarkable life span. Data of a complete character are still meager on pole life, so that generalizations are unsafe.

Compares Cost and Life of Different Classes of Poles

An interesting comparison of pole cost and life of pole was made by the committee. The poles chosen were 35 ft. with 7-in. top made of juniper, Western red cedar and creosoted pine. Costs were computed at the end of twenty years and at the end of 40 years and the assumption was made of 40 years of life for creosoted pine. These cost data are as follows:

TABLE IV—COST OF JUNIPER, WESTERN RED CEDAR AND CREOSOTED PINE POLES AT END OF TWENTY YEARS

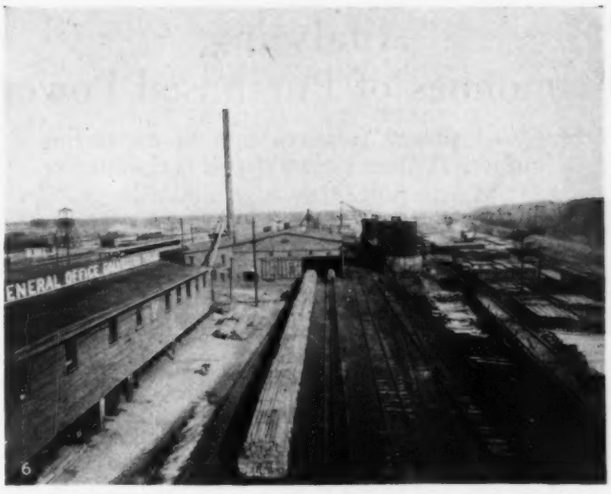
	Juniper	Western Red Cedar	Creosoted Pine
First cost	$13.88	$19.07	$18.04
Replacement at end of life	13.88	.....	.....
Transferring	2.00	.....	.....
Total	$29.76	$19.07	$18.04
Annual cost at end of twenty years	1.49	0.95	0.91

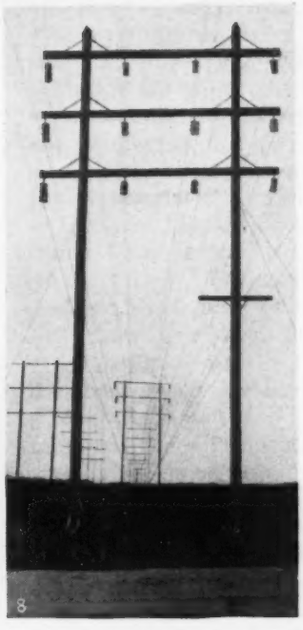
TABLE V—COST OF THE SAME KIND OF POLES AT END OF FORTY YEARS

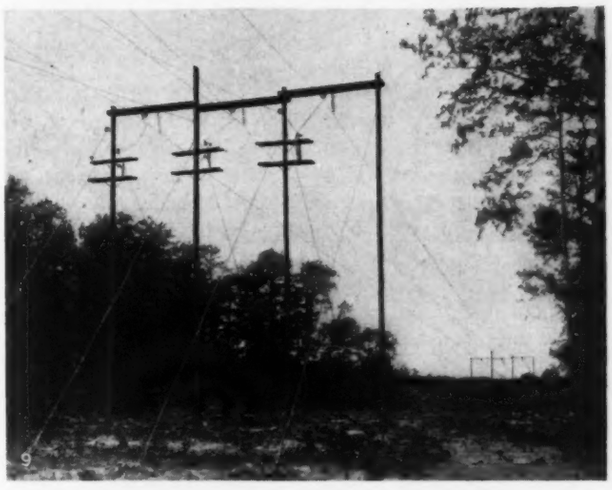
	Juniper	Western Red Cedar	Creosoted Pine
First cost	$13.88	$19.07	$18.04
Replacement cost	47.64	21.07	.....
Total	$61.52	$40.14	$18.04
Annual cost at end of 40 years	1.54	1.00	0.45
Per cent	2.42	1.22	.....
Force to break pole, lb.	1,140	1,420	2,200

The consensus of opinion favors the use of No. 1 domestic oil for creosoting, using the A. T. & T. empty cell specifications with 8 or 10 lb. treatments. No very accurate records are kept on life of poles and effects of treatment, but the trend is to discontinue butt treatment toward the full creosoted treatment.

The use of creosoted products is increasing rapidly, and the woods operations and treatment processes have been perfected by reputable companies. There is no doubt this strong, long-life material will continue to hold an important place in the timber market and will afford utilities a source of supply for poles, ties and structural timber. Many reports on service experience with creosoted poles where the poles have been handled properly from woods to consumer show that failures in service are negligible and that a long life can be obtained. The creosoted pole purchased in an intelligent manner is a pole that may be relied upon by the industry.







Three types of Southern lines using creosoted Southern pine poles

6. Ties loaded on freight cars ready for delivery to the treating retorts.
7. A 66-kv. line using creosoted poles. Southwestern Gas & Electric Company.
8. A four-circuit, 66-kv. line using creosoted poles and crossing swampy territory.
9. Unusual construction of a 66-kv. line using creosoted poles for supporting the conductors.

Analyzing Economies of Purchased Power

Study of power requirements of expanding industrial plant shows that it is cheaper to buy power than to make it

By H. C. Thuerk
Manager Erie Lighting Company, Erie, Pa.

IN THE early part of 1926 it became necessary, on account of an increased demand for its product, for one of the primary power customers of the Penn Public System to erect new factory buildings. This company manufactures a specialty product and employs a considerable number of automatic machines in its manufacturing process. All of the heat-treating necessary is accomplished in six electrically heated furnaces. No process steam is required in the manufacturing process, the only requirement for steam being for heating in the winter time.

When several methods of doing a job are available, there is no more reliable way of determining which is the most economical than to establish a balance sheet on which advantages and disadvantages of each procedure can be listed and evaluated. The accompanying article illustrates an analysis which one industrial concern made to determine whether to purchase power or generate it. When all fixed and operating charges are included there will be little opportunity for differences in conclusions unless choice of unit figures or evaluation of intangibles are questioned.—Editor.

An investigation was made at this particular time to determine if any savings could be made by installing a small power plant and generating power instead of purchasing it as was being done at the time. A preliminary investigation showed that it was not practicable to consider the installation of a steam-engine-driven plant. The consideration finally narrowed down to either the continuation of purchased power or the installation of a Diesel engine-generating plant.

The power requirements during the first six months of 1926 are given in the table below.

On the basis of power requirements for the first half of 1926 it was decided that the present load should be considered as having a demand of 150 kw. and a monthly consumption of 40,000 kw.-hr. It was estimated that when the industry moved into its new buildings the average monthly consumption should be 80,000 kw.-hr., with a maximum demand of 225 kw. The power factor was assumed to be 90 per cent, as a considerable portion of the load consisted of electric heat-treating furnaces, which operated at a very high power factor.

It was agreed that the proposed Diesel engine plant should consist of two units, each unit to consist of one 350-hp. engine direct connected to a 225-kva., 230-volt, three-phase, 60-cycle alternator. The estimated cost of the proposed plant is given in the accompanying table.

In the first item of the table it is assumed that this includes the erection of the engines and the services of an erecting engineer. It also includes a complete switchboard for the two units and all other auxiliaries not mentioned elsewhere in the estimate. It will be noted that the table does not include the cost of the building to house the power plant, nor the rental value of space which might be occupied by the plant in one of the new buildings. No allowance was made for the installation of a crane or hoist for facilitating repairs or for possible alterations to one of the new buildings to accommodate the proposed engines. It will be seen that the cost of the proposed plant was approximately $133 per kilovolt-ampere, which represents a conservative estimate for a plant of this size.

Fuel and Lubricating Oil Costs

In determining the fuel and lubricating oil consumption and maintenance costs for the proposed plant reference was made to the operating data of a large number of Diesel engine plants. This substantiating data appeared in the Electrical World of March 5, 1927, under the title "What Are Diesel Engine Power Costs?" Since the results of 58 Diesel engine plants were tabulated in this article, it was felt that these operating data were fairly reliable.

A fuel consumption of 0.75 lb. per kilowatt-hour generated was used in determining the fuel cost of the proposed plant. With fuel oil weighing 7½ lb. per gallon, this represents a performance of 10 kw.-hr. per gallon of fuel. The management of the company based the cost of fuel oil at 8 cents per gallon delivered in tanks at the power plant. Lubricating oil consumption was taken at 800 kw.-hr. per gallon, at an average cost of 60 cents per gallon.

Repairs and Maintenance

Maintenance was taken at 2¼ mills per kilowatt-hour generated. This includes both labor and material. The item of maintenance is one which varies widely, depending upon a number of factors. It is only by taking an average value of a number of plants which have been in actual operation for some time that it is possible to obtain an estimate that will be reliable.

Attendance Labor

The management of the company decided that one-half of one man's time at 70 cents per hour should be charged against the operation of the oil engine plant. There was some question as to whether a competent

POWER REQUIREMENTS DURING FIRST SIX MONTHS OF 1926

Month	Kilowatt Demand	Kilowatt-Hours
January	160	38,000
February	152	38,400
March	152	40,400
April	144	38,000
May	152	28,800
June	136	24,800

ESTIMATED COST OF PROPOSED GENERATING PLANT

Engines and alternators, including erecting	$50,000
Freight—300,000 lb. at 16½ cents per 100 lb.	495
Haulage at $3 per ton	450
Foundations—100 cu.yd. per unit at $12	2,400
Fuel oil storage tanks and piping	2,000
Auxiliaries, including air compressor, oil pump, etc.	2,000
Engineering, supervision, inspection and contingencies at 5 per cent	2,800
	$60,145

operator could be obtained at this figure, but it was finally decided to use this amount in determining the power costs.

The power taken by the auxiliary equipment in the plant would probably approximate between 3 and 5 per cent of the gross generated kilowatt-hours. It was assumed that the losses in transformers when power is purchased would just about compensate for the power used by the auxiliaries. It was estimated that for cooling water 1 cu.ft. per kilowatt-hour would be required.

Fixed charges, which included interest, depreciation, taxes and insurance, were taken at 15 per cent. In the comparison of power costs it was pointed out that one manufacturer of oil engines places depreciation alone at 8 per cent, and that the Inland Revenue Authorities in England increased the depreciation from 5 to 10 per cent in 1927 on Diesel engine plants after such a request had been made by the Diesel Engine Users' Association of that country.

Comparison of Total Costs

Having decided upon the various quantities to be used in the cost computation, a table showing power costs under existing and future load conditions was prepared.

The total annual cost of purchased power for the present load was $10,231.44, or an average cost of 2.13 cents per kilowatt-hour. This represents an annual saving through the purchase of power of $5,458. This cost was based on the use of the regular industrial power schedule of the Penn Public System.

Under future load conditions it would be possible to make use of a combination of the regular power rate and the off-peak power rate. The total annual cost of purchased power for future load conditions would be $16,233.60, or an average cost of 1.69 cents per kilowatt-hour. The total annual saving of purchased power under future load conditions would be $5,096.

The investment cost necessary in transformer equipment for purchasing future power requirements was approximately $2,000. At 15 per cent the annual fixed charges on this equipment would be $300. Deducting this from $5,096 gives a net annual saving of $4,796.

In the cost comparison no mention was made of the costs for supervision. The operation of a 700-hp. Diesel engine plant would require a certain amount of some executive's time. A conservative value of the item of superintendence in this case would be $500 per year. It was pointed out that in considering the cost of operating an oil engine plant it should be remembered that there has been a decided upward trend in the price of fuel oil. This was shown in charts giving the posted prices of crude oil at the wells.

As a result of the investigation and comparison of costs, it was decided to purchase power and new contracts were accordingly signed.

COST OF GENERATING POWER FOR PRESENT AND FUTURE LOADS

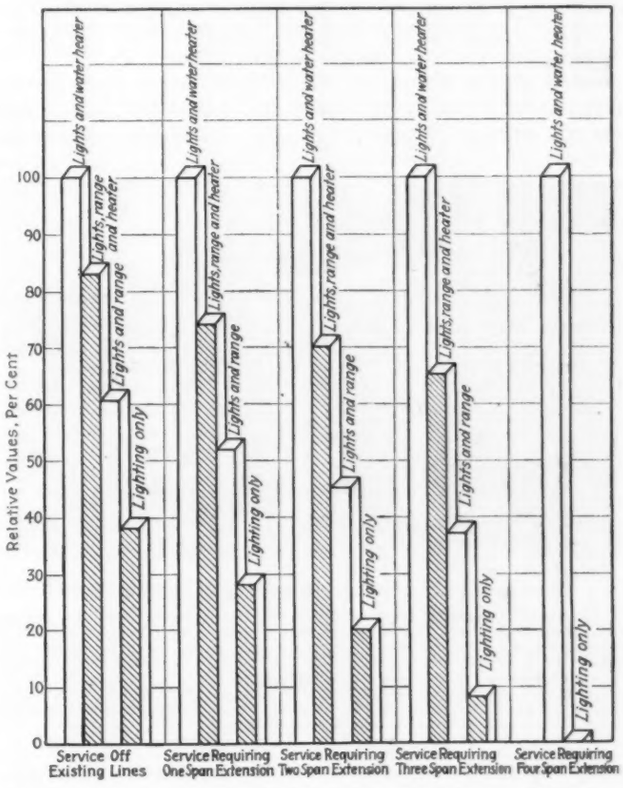
	Present Load	Future Load
Fixed charge—15 per cent of $60,000	$9,000.00	$9,000.00
Fuel at $0.08 per gallon	3,840.00	7,680.00
Lubricants at $0.60 per gallon	360.00	720.00
Repairs and maintenance at $0.00225 per kilowatt-hour	1,080.00	2,160.00
Cooling water at $0.10 per thousand gallons	360.00	720.00
Attendance labor	1,050.00	1,050.00
Total	$15,690.00	$21,330.00
Annual kilowatt-hours	480,000	960,000
Cost per kilowatt-hour	$0.0327	$0.0222

Relative Values of Different Classes of Residential Service

By D. F. McCurrach
Rate Engineer Northwestern Electric Company, Portland, Ore.

IN ORDER that salesmen and solicitors of residence business might be informed as to the relative values of different classes of residential business and also advised as to the decrease in value of business due to line extensions required, as compared with the same service rendered from existing distribution facilities, the Northwestern Electric Company, Portland, Ore., prepared the accompanying chart.

In order not to complicate the matter with allocation of power plant, transmission line, substation and distribution system investment, which, notwithstanding the number of theories advocated, must of necessity be arbitrary, the investment in the service, transformers, meters and the additional span costs alone were considered. The fixed charges on this investment were assumed at 15 per cent and the operating costs, such as cost of energy, operation and maintenance of meters, services, ranges, etc., commercial expenses and miscellaneous expenses, were assigned on the basis of average unit costs maintained by this company. On this basis a net revenue was obtained by deducting these costs from the gross revenue to be obtained by application of existing tariff rates. The ratio of net revenue to cost of extension was then obtained and each ratio expressed as a function of the most favorable condition, namely, that resulting from the greatest utilization of service from the existing distribution system, which has been plotted as 100 per cent value.



CONSUMER-VALUE CLASSIFICATION FOR RESIDENTIAL DISTRICTS UNDER SIMILAR CONDITIONS OF SERVICE

The chart is self-explanatory and shows comparative relative values for the classes of service shown. It is believed that this method, while probably not perfect, is a considerable guide and help to salesmen in visualizing the situation and realizing the importance of increasing the load of existing customers on existing lines, as contrasted with soliciting business that requires considerable distribution extension for small loads, the effect of which must of necessity have a material adverse effect on the net income.

Bus Used for Appliance Demonstrations

THE Pennsylvania Edison Company is using a city type bus with seats removed to show the public the latest labor-saving household devices operated by electricity. The company does not solicit sales, but demonstrates the various machines on display. A desire is created in the minds of the visitors for a waffle iron, dishwasher or other appliance and a broader market for electric energy is produced. No prices are mentioned unless a direct request is made regarding a certain machine. In other words, the whole idea is to educate the public in the use of electricity and therefore increase the consumption of electric energy.

Motor bus becomes an itinerant showroom

An 8-gal. capacity tank underneath the vehicle supplies water for demonstrating the dish-washing and clothes-washing machines as well as an electric pump which is used to force the water into these machines from the tank. Among the various items exhibited in the bus are washing machines, an electric dishwasher, an automatic water heater, an electric range, and electric refrigerator, fans, waffle irons, percolators, small heaters, vacuum cleaners, and a sewing machine.

Power for the operation of the various appliances in the bus is taken from the company's service lines near the spot where the traveling exhibit is parked. A transformer has been installed on the back of the bus to take care of the energy requirements. When the bus is moving the lights use 12 volts direct current from the engine. When the exhibit is parked in a residential community power is supplied from the service line and the lighting supply is stepped down to 12-volt alternating current through a special transformer. The truck is a standard city type bus, six-cylinder model, a product of the Mack-International Motor Truck Corporation, altered by the addition of more lights, a water tank and a few power sockets. This traveling electrical exhibit before it gets back home this spring will have covered many communities in New Jersey, eastern Pennsylvania, southern New York and towns along the Atlantic seaboard.

Letters from Our Readers

What Can Be Done for the Budding Engineer?

To the Editor of the ELECTRICAL WORLD:

It is generally recognized that the successful professional engineer must have a fundamental engineering background, possess self-confidence, vision and the ability to write and speak forcible and convincing English, and exercise reasonableness in his dealings with subordinates.

What about the adolescent engineer, who has obtained the engineering fundamentals and knowledge of English in our colleges, but who has had no opportunity to realize that self-confidence, vision and reasonableness are essential in business? These aptitudes are not given in the college curricula, hence they must be obtained in the industry if we are to bring forward our future executive engineers.

Manifestly vision covers length and breadth of view, also correction of perspective. Length of view enables the engineer to judge the trend of events so that he may allow for the future. Breadth of view allows him to consider the problem from all angles. Correction of perspective permits its possessor liberty from prejudice and prevents him from enlarging on small matters, as well as making him think that the improbable is impossible. Correction of perspective makes him lean toward allotting his detail work to specialists, thus leaving the executive free to direct. These ideas may be given to the junior engineer in the form of guidance.

Self-confidence should not be confused with positiveness, for they are clothed much the same, but produce entirely different results. The self-confident man can be relied upon to have a large percentage of success in his problems and studies. In considering his few failures he has learned to investigate before making a decision, also to evaluate all factors concerning the problem and to distinguish the imperative from the non-essential, which he neglects. He realizes that when the job has been started it must continue, and that an alternative plan must not be considered unless pressure is brought to bear due to unforeseen obstacles. Before considering a job complete he reviews it, thus weighing his various ideas and factors governing its progress, and then ratifies or confirms them according to their relative importance. Accordingly, he knows how to attack a problem when it presents itself for solution and can therefore expect a reasonable amount of success.

But how can self-confidence be conveyed to the adolescent engineer? By a sympathetic superior. What more will retard self-confidence in the junior than to have his plans and ideas continually criticised and rejected? It is, then, important, though often difficult, for the superior to conceive the idea that there are many logical ways of attacking a problem; further, he may be getting somewhat set in his methods and does not see that the original plan submitted by the junior may, once slightly reclothed, be better than his own. Considering the furtherance of self-confidence, it is often advisable to pass a reasonably good plan presented and let it be carried out, even when you know a better way. It is useful, though not flattering to your vanity, to guide the subordinate carefully until he suggests, as he thinks on his own initiative, the plan you desire to have followed.

M. D. S.

Digest of Electrical Literature

Generation, Control, Switching and Protection

The Parallel Operation of Generating Stations.—J. DEFREYN.—The author has illustrated, by means of vector diagrams and charts indicating system and station operating conditions, a means of independent voltage regulation using the power factor. The problem of voltage regulation is stated to have been successfully solved in several ways, one consisting of the introduction into the circuit of an additional electromotive force which compensates either for the drop in pressure alone or also for the poor power factor resulting from the distribution of energy in the transmission lines and in the apparatus comprising the load. Such a result is obtained by means of the compounding of voltage regulators or by multi-tap transformers, boosting transformers, induction regulators or by rotary boosters. The placing of synchronous condensers in part of the networks is a common method of utilizing the second principle.—*Brown Boveri Review* (*Switzerland*), February, 1928.

Electrical Engineering in 1927.—A review of the developments in contemporary electrical engineering practice, including a reference to design improvements in iron-clad switchgear. It is stated in this review that outdoor iron-clad switchgear may now be obtained in England for potentials up to 220 kv. New designs combine the principles of compound-filled gear with the ordinary cubicle type layout, a device which is said to enable the engineers to inspect the isolating switch contacts and their operation, while at the same time each piece of apparatus is essentially iron-clad without intervening bare connections. The equipment is suitable for indoor or outdoor use and permits phase separation. Circuit breakers having a rupturing capacity of 1,500,000 kva. are now available in British manufacture.—*Engineer* (*England*), Jan. 13, 1928.

Transmission, Substations and Distribution

Arcing Tests on Cables.—D. I. FUCHS-KAUFMANN.—Wind or the sudden shedding of sleet may cause cables of an overhead transmission line to clash, causing destructive arcing. The authors investigated the durability of various types of cables when subjected to heavy arcs. A certain length of each cable tested was stretched out with a tension comparable to standard line practice. A copper block was fastened $\frac{1}{8}$ in. away from the cable and a single-phase short-circuit arc from a 750-kva. generator, corresponding to 350 amp. at 2,500 volts, was established between the copper block and the cable. Stop-watch timing was used from the instant of closing the breaker to the rupture of the cable due to melting. Two series of tests were made, with: (1) one end of the cable connected to the generator, and (2) both ends of the cable connected to the generator; the first series to resemble a single-way transmission line, the second series to imitate a ring or tie-line. Fifteen types of cables were tested, representing solid copper, solid aluminum, combination aluminum and steel, and hollow cables. Solid copper cables withstood longest, with copper alloy cables in second place, combination cables in third place and aluminum cables in the last place. Hollow cables lasted longer than equivalent solid cables. — *Elektrotechnische Zeitschrift*, Jan. 26, 1928.

Overhead Transmission.—G. R. FALKINER NUTTALL.—A general consideration of the various factors utilized in the specification and design of overhead transmission lines. Among the factors considered are steel-core aluminum cables, progress in insulator design, reinforced concrete and galvanized steel structures, the determination of clearances, the spacing of conductors, the method of erection, and excavating practices. A tabulated record of contemporary transmission line practices in the United States is offered in connection with the discussion. The result of investigations upon the characteristics of porcelain in tension and a comparative estimate of the value of the several means of supporting the line are offered. —*Electrician* (*England*), Jan. 27, 1928.

Units, Measurements and Instruments

Daylight Recording by Means of the Photo-Electric Cell.—L. R. KOLLER.—The recording of daylight intensity is another application of the photo-electric cell. This device, coupled to a suitable automatic recording instrument, offers a simple arrangement providing a means of great possibilities for investigating daylight conditions. The limitations of the usual photometer render the use of the photo-electric device of particular interest. — *General Electric Review*, February, 1928.

Harmonic Analyzer for Use on Power Circuits.—Rapid advances and refinements in the science of inductive co-ordination have made imperative the securing of accurate information concerning wave forms in both communication circuits and power circuits. An instrument which meets the requirements of portability and ease of operation without excessive cost has been developed, and while it is not offered as a perfect device it is believed that refinements have proceeded to a point where reasonably satisfactory results may be obtained. The analyzer consists essentially of a voltmeter capable of measuring the magnitude of any single-frequency voltage in the range of 60 to 3,000 cycles. Analyses of current are made by measuring the voltage drop across a resistance or inductive shunt. The sensitivity for current measurements may be increased by means of an input coil which is provided for the purpose. The apparatus is fundamentally a double-tuned circuit with single-stage vacuum tube amplification, the output of which is fed into a copper oxide rectifier. The rectifier current is passed through a direct-current micrometer, affording a direct reading of the measured voltage.—*Serial Report Inductive Co-ordination Committee, National Electric Light Association*, January, 1928.

Illumination

Lighting Measurement.—G. W. STUBBINGS.—A discussion of the determination of the mean spherical candlepower by means of the Rousseau curve. The author has pointed out the desirability of utilizing this diagram in the determination of illuminating effect and points out that such a period does not meet all of the usual requisites and that a modification somewhat similar to the plan proposed by Dr. Rousseau has notable advantages.—*Electrical Review* (*England*), Jan. 20, 1928.

The Effect of Different Systems of Lighting on Output and Accuracy in Fine Work.—H. C. WESTON and A. K. TAYLOR.—A joint report of the Industrial Fatigue Research Board and the Illumination Research Committee of Great Britain. A previous report embodied the results of an investigation into the optimum illumination required for typesetting by hand or composing in the printing industry and was limited to the study of adequacy in a quantitative sense, and no attention was paid to the almost equally important matter of distribution of light over the working area or, in other words, to the system of lighting tending to give the best results. The results of the experiments described are not so positive as those obtained by varying the degree of illumination provided, but, given sufficient illumination, there is no reason to expect that large differences either in output or accuracy would result in the different characteristics of most of the methods of lighting tried. It is stated that in some composing rooms general lighting may be unsuitable on account of structural features which will prevent the elimination of undesirable shadows, and in such cases the combination of general and local lighting in which the two types of source will give approximately the same proportion of the total illumination is to be recommended. Totally indirect lighting involves a loss of output but has the advantage of reducing the reflected glare on the type. It is stated that there is

some evidence that the color of the light used in composing rooms may be of importance in relation to the question of glare, but that without further experiments no definite statements on this point can be made. Particulars of the installation relative to the output and comparison of morning and afternoon work under various conditions of illumination are described.—*Department of Scientific and Industrial Research (England)*, 1928.

Heat Applications and Material Handling

Large Electric Baking Ovens.—W. ELLERD-STYLES.—The progress that has been made in the development of small electric ovens in England is stated as being extensive, whereas larger installations have lagged behind in most instances. In dealing with the cost of operation the author states that the average consumption is about 90 watts per pound of baked bread. The various factors entering into the cost of electrical operation and the advantages attendant upon the use of this heating medium, as well as the features of automatic temperature control which have been provided for such installations and a consideration of the interest of the supplying utility, have been included.—*Electrician (England)*, Feb. 3, 1928.

Large Pipe for High Head Made by Arc Welding.—T. UJIIYE. — Electric welding was applied in the construction of a 1,942-ft. penstock of a Japanese hydro-electric development. The procedure under which the material was fabricated, the specifications under which the job was done, the anticipated advantages of welding construction, with particular reference to the present undertaking, and the duty requirements of the installation are given.—*Iron Age*, Feb. 16, 1928.

Electrophysics, Electrochemistry and Batteries

Some Principles Governing the Choice and Utilization of Permanent Magnet Steels. — RAYMOND L. SANFORD. — The addition of substantial percentages of cobalt to the composition of permanent magnet steel leads to markedly superior qualities. The cost of cobalt steels may be several times that of the older types and consequently their use is warranted only under certain conditions. Criteria for the comparison of magnet steels are discussed and conditions under which the use of the more expensive steels is justified are outlined. The author states that cobalt steels, while superior in quality to tungsten and chromium steels, may not display this superiority unless appropriate designs are utilized. Magnets may be stabilized against permanent deterioration from transient demagnetizing fields by partial demagnetization. The cobalt steels can be stabilized by this method to a greater degree than the steels having lower values of coercive force. In general, it is concluded that by the use of cobalt steels some results may be obtained which are utterly impossible with the tungsten and chromium steels more commonly employed, but that the economical justification for their use is not encountered except in cases where space or weight are of primary importance and cost is of secondary consideration or where particularly severe conditions must be met.—No. 567 *Scientific Papers of the Bureau of Standards.*

New Type Storage Cell.—L. JUMAU. —When charged and then left idle for one year before it is discharged, the cell will give only 33 per cent less energy than if it had been discharged immediately after the charge, according to the author. The cells are made in three sizes, from 20 to 80 amp.-hr., and are completely sealed except for a self-closing gas vent. There are only two very thick plates in each cell, and the unusual charge-retention characteristics are due primarily to the exclusion of local chemical action in the plates. Exceptional purity of all active materials, a special form of the plates, very careful perforation and secure lodging of the plates in a grooved glass container are contributing factors. When used for signaling purposes, heating of filaments in radio tubes, electric clocks, etc., it was found satisfactory to charge such batteries only twice a year.—*Revue Générale de l'Electricité*, Dec. 3, 1927.

Telegraphy, Telephony, Radio and Signals

Television.—A. DAUVILLIER. — In a series of three consecutive articles the author summarizes all the hitherto known and practically applied methods of transmitting an image over wires. Each method is described and illustrated with a sufficient amount of detail to comprehend its operating principles. The second part of the paper is devoted to an unusual X-ray method, utilizing the basic principles of television; that is, instead of subjecting the subject to a flood of X-rays and examining the shadowgraph on a fluorescent screen, the new method uses only a very small beam of X-rays, which is quickly moved over the examined area and is at the same time integrated again to give the complete image. This process is so fast that the object under examination may be in motion. Heart palpitation may thus be readily examined. Two great advatages are claimed for this new X-ray process: (1) The patient is subjected to only a fraction of the commonly required dose of rays, eliminating entirely the possibility of X-ray burns; (2) a much clearer image is obtained, since the veiling action of all secondary rays is eliminated.—*Revue Générale de l'Électricité*, Jan. 7, 14 and 21, 1928.

The New York-London Telephone Circuit.—S. B. WRIGHT and H. C. SILENT.—The special provisions which are in use on the transatlantic telephone to compensate for the variability of the wire and ether paths, for the radio noise and for the fact that two-way transmission is effected upon a single wave length is discussed in this paper. Technical operators are in attendance at each end of the radio path and are equipped to adjust the magnitude of the speech currents entering the radio transmitters to such a value as to load these transmitters to capacity. The amplification introduced at the radio receivers can also be adjusted to compensate for changes in the transmission efficiency of the radio paths. Finally, voice-operated relays together with suitable delay circuits are provided which so control the apparatus that at any given time it can transmit in but one direction. By this arrangement, a speaker's voice upon leaving his transmitting station cannot operate his own receiver, although this is tuned to the transmitting wave length.—*Reprint B-275 Bell Telephone Laboratories, Inc.*

Traction

Electric Snowplow.—An electric rotary snowplow has recently been installed on a section of the Swedish State Railway lying above the Arctic Circle. Because of the extreme climatic conditions special precautions were necessary in the design of this equipment. The snowplow is not provided with motive power, but is pushed from behind by an electric locomotive which may be controlled from the driving cab of the snowplow. The motor for the operating of the plow-wheel shaft has a rating of 565 hp., but may be momentarily overloaded by 100 per cent. The motor is a series-wound, single-phase device of the same type and appearance as those used for electric locomotive drives. The motor is placed longitudinally and is provided with a cast-steel stator frame bolted to the bedplate. The plow-wheel shaft is driven through a helical single reduction gear. The gear pinion is combined with a brake drum and against this two brake blocks can be pressed, the operating force being secured by the use of air pressure so that both the rotor and plow wheel may be braked at the same time.—*Electrician (England)*, Jan. 20, 1928.

Miscellaneous

The Maclaurin Smokeless-Fuel Plant at Glasgow.—The design and construction of a plant for the production of smokeless fuel is offered in this article. The producer unit bears some resemblance to a blast furnace, although it is square and raised above the ground on piers. A center wall near where the air ports enter divides the producer into two large chambers, while higher up are an oil trap and a gas and oil outlet. The coke, after cooling, is discharged through chutes at the bottom of the producer. The operation of the plant is referred to in considerable detail.—*Engineering (England)*, Feb. 3, 1928.

News of the Industry

New San Francisco Rates

Domestic Customers Will Pay Monthly Service Charge of 40 Cents Plus Energy Charge Beginning at 5 Cents for First 200 Kw.-Hr.

REDUCTIONS in the electric light and power rates of the Pacific Gas & Electric Company and the Great Western Power Company, representing a saving to consumers of nearly $2,000,000 a year, briefly referred to last week, have been approved by the Railroad Commission of California in a decision giving the consumers the immediate benefit of the reduced rates. The commission has, however, continued for further hearing and final determination the various rate proceedings relating to those two companies which have been pending before it as the result of complaints by various cities and on the commission's own investigation.

In addition to authorizing the reductions proposed by the power companies affecting residential and general power and light consumers, the commission ordered a revision of agricultural power rates the net result of which will be a saving of approximately $65,000 to that class of consumer. The change in agricultural rates was ordered by the commission in response to the plea of the California Farm Bureau Federation for a new agricultural pumping service rate which would eliminate optional rates now in effect, open the schedule to new types of service and effect a general reduction, although increasing the bills of a few consumers.

The principal effect of the proposed changes in the general and domestic electric rates will be a lowering of the lighting rate to the lowest point yet reached in the territory of the companies involved and the establishment of extremely low rates for the operation of electrical appliances and household devices. The reductions applicable to general lighting service, including household appliances and small power service, became effective for meter readings on and after March 1, and the reductions in the general power and agricultural rates and the new combination domestic service rate will be effective on and after April 1.

The new domestic rates in San Francisco, Oakland, Berkeley, Piedmont, Emeryville, San Leandro and Albany are as follows: Service charge per meter per month, 40 cents; energy charge (to be added to service charge), first 200 kw.-hr. per meter per month, 5 cents; next 800 kw.-hr., 4 cents; next 2,000 kw.-hr., 3 cents; all over 3,000 kw.-hr. 2½ cents. In incorporated cities served by the companies outside those above named the rates will be the same except that the service charge will be 50 cents. In unincorporated territory the service charge will be 70 cents and the energy charge for 200 kw.-hr. 6 cents, for the next 800 kw.-hr. 5 cents; for the next 2,000 kw.-hr. 4 cents, and for all over 3,000 kw.-hr. 3½ cents.

The general domestic combination service rate in San Francisco, Oakland, Berkeley, Piedmont, Emeryville, San Leandro and Albany will be (with extra charges where there are more than six rooms or where devices rated at more than 1 kw. are installed): Service charge per meter per month, 40 cents; energy charge, first 30 kw.-hr., 5 cents; next 140 kw.-hr., 3½ cents; all excess, 1½ cents.

Engineers Will Honor Dr. Cornelis Lely of Holland

Engineers will honor Dr. Cornelis Lely, president and honorary member of the Netherlands Royal Institute of Engineers and member of the Royal Academy of Sciences, at a luncheon to be given at the Engineers' Club on Tuesday, March 6, at 12 o'clock. This luncheon will be under the auspices of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Dr. John R. Freeman will preside.

Amendment to Norris Resolution Favored

Harrison's Plan Vests Question of Government or Private Operation of Muscle Shoals in Secretary of War—Federal Trade Commission Ready to Subpoena

By Paul Wooton
Washington Correspondent of Electrical World

MUSCLE SHOALS legislation which is fairly acceptable to the opponents of the government's entering business apparently is about to be approved by the Senate. As this is written, it seems probable that the Harrison amendment to the Norris resolution will be adopted. The Norris resolution requires that the power plants be operated by the government, which is to sell energy to "states, counties, municipalities, corporations, partnerships or individuals," giving preference to states, counties and municipalities. The Harrison amendment vests in the Secretary of War the decision as to whether the power plants are to be leased to private operators or are to be operated by the government. In the event of government operation of the dam and steam plant, however, no municipality may receive a greater amount of power than it is entitled to receive under the principle of equitable distribution for which the amendment stands, and all power sales are confined to the switchboard. The Harrison amendment also provides that the energy is to be sold for public use subject to state regulation.

The theory of the Norris resolution, as well as of substitutes proposed by Senator Tyson of Tennessee and by Senator Sackett of Kentucky, is to separate power and fertilizer production. This is in line with the view of the majority of the members of the Senate. In each of these measures the proceeds from power are to be used for a period of years in an effort to demonstrate the practicability of the use of air nitrogen as a fertilizer ingredient. In addition, experiments are to be conducted in the production of phosphoric acid and other ingredients of fertilizers in an attempt to devise means of reducing production costs. It is the conception of these three bills that a considerable part of the money, however, shall be used to conduct on farms practical demonstrations of concentrated fertilizers.

All of the proposals authorize the Secretary of War to enter upon transmission-line construction in order to place him "upon a fair basis for making contracts and for receiving bids." Proceeds from the sale of power may be used for that purpose without additional authority from Congress. The Norris resolution authorizes additional equipment for the dam and for the steam plant. This equipment, it is estimated, will cost in excess of $10,000,000. The Harrison amendment does not modify the Norris resolution in that respect.

It is generally conceded on the House side that the Madden bill is dead. Apparently a majority of the House military affairs committee now favors the Morin bill, which is very similar to the Norris resolution. It is believed that the Norris resolution, as amended, will be just as acceptable to the House committee, but no decision has been made as to which of the two bills will be pushed by the House committee.

The Federal Trade Commission is about to decide upon the form its investigation of the electrical and gas industries will follow. The adoption of this plan has presented numerous difficulties, as have the questions involved in the subpœnaing of witnesses. As this is written, it is expected that the subpœnas will go forward within a few days. As a result of the publicity given

the utilities investigation, the commission has been deluged with applications for employment from persons who state that they are particularly qualified to be of assistance in such work. It became necessary for Chairman Humphrey to issue a public statement pointing out that the commission has received no extra appropriation for this investigation and at present expects to proceed with the inquiry without additions to its regular staff. Numerous engineers and economists were among the applicants.

La Guardia Bill to Limit Federal Court Jurisdiction

Congressman F. H. La Guardia of New York has again introduced his bill to restrain the United States courts from setting aside orders made by state public service commissions concerning the operation or rates of public utility companies until the state courts have passed upon the points at issue. This is the third time that he has fathered this bill, which is similar to one formerly championed by Congressman Bacharach of New Jersey. Mr. La Guardia has issued a statement denouncing federal court findings in the New York City gas cases and asserting: "It was never intended that United States district courts should intervene in the first instance to permit public utility companies disregarding law or obligations under contracts. The custom now has become so general, the power of traction and other public utility companies so great, the exploitation of the people so ruthless, that Congress must step in and curb this evil."

Legislator Questions Rates in Boston and Near By

H. L. Shattuck, a member of the Massachusetts House of Representatives, has filed an order asking the Department of Public Utilities to inform the House not later than March 15 whether the commission favors making inquiry with the object of bringing substantial reductions in the rates of the Boston, Lowell, Lawrence, Lynn, Fall River, New Bedford, Malden, Quincy and Brockton companies, and also whether the Boston Edison company's maximum rate of 8½ cents per kilowatt-hour is in part due to the extension of the company's service into sparsely settled territory, and whether the establishment of a zone system of rates is advisable in order that the congested portion of the area served may obtain a rate which takes into account the lower cost of serving that part of the territory.

Men from Four States at Albuquerque

Thoroughly Practical Three-Day Convention of New Mexico Utilities Association Appeals to Executives of Rocky Mountain Region and Western Texas

MEN from Colorado, Wyoming, New Mexico and Texas were in attendance at the thirteenth annual convention of the New Mexico Utilities Association, which was held at the Franciscan Hotel in Albuquerque on Feb. 20-22. J. B. Ledlie, Mesilla Valley Electric Company, former president of the association, reviewed its past accomplishments and outlined future opportunities. Sales efforts, he said, are of immediate importance and "our biggest job."

Miss Frances B. Ryder, chairman of the women's committee, Rocky Mountain Division, N.E.L.A., painted a picture of the increasingly large and important part that women are taking in the field of public service. Dr. James F. Zimmerman, president of the University of New Mexico, outlined difficult problems in the field of education. "Public Relations—the New Concept" was the subject of V. L. Board, general superintendent Public Service Company of Colorado. Mr. Board thought that prejudice against the public utilities is largely inherited and can be dissipated by education.

A. R. Woolley, Edison Electric Appliance Company, Denver, spoke on "Central-Station Merchandising from the Standpoint of the Manufacturers." He asked whether the utilities are analyzing the merchandise they offer from the standpoint of its dependability and the integrity of its manufacturer. H. B. Dwight, engineer for the Colorado Public Utilities Commission, took up public relations, which, he said, are "nothing more than public confidence, and confidence can be established in a large measure through the proper training and education of employees." "Why All the Secrecy?" was the question asked by George E. Lewis of the Rocky Mountain Committee on Public Utility Information. Mr. Lewis insisted that utility managers let their employees in on the results obtained from conventions such as the one in session.

J. J. Cooper of the Mountain Electric Company, Denver, had for his subject "What Price Success?" He outlined the "new competition" and emphasized the necessity for intensive market development. H. C. Webb, Jr., sales manager El Paso (Tex.) Electric Company, pointed out that production problems have received far greater attention than those related to merchandising. He told of an experiment his company is now trying which calls for the establishment of district representatives for all residential territories within the city. These men have approximately 900 customers each and are doing the combined work of meter reader, salesman and collector.

Tuesday morning's session was given over to a complete discussion of the Colorado River development. Following a brief review of the situation by Merrit C. Mechem of Albuquerque, Francis C. Wilson of Santa Fe, Colorado River commissioner for New Mexico, explained the many features of the proposal in detail and prophesied practical reconciliation of the various opposing factions.

"Central-Station Possibilities in Street and Highway Lighting" was handled by A. S. Anderson of the General Electric Company, Denver. Philip S. Donnell, dean of engineering, University of New Mexico, presented "The Problem of Power Factor." Its technical side has been taken care of, he asserted, and it now remains for the utilities to convince the consumer. Recent engineering developments in the electrical industry were described by R. W. McNeill, Westinghouse Electric & Manufacturing Company, Denver, who dealt with steam-turbine construction, synchronous motors, electric house heating, transportation, transmission equipment and automatic substations.

A. C. Cornell of the Graybar Electric Company, Denver, talked on "Possibilities of Developing an Electrical Consciousness." Of commercial managers he said: "Five-thousand-dollar-a-year executives are expected to do the work that should be done by fifteen-thousand-dollar men."

Officers elected to serve the New Mexico Utilities Association for the ensuing year are: President, C. C. Ogle, Agua Pura Water Company, Las Vegas; first vice-president, W. W. Nielson, Santa Fe Water & Light Company; second vice-president, C. S. Makeig, Roswell Public Service Company; secretary-treasurer, B. L. Wiles, Albuquerque.

Northern States Power Budget Includes New Offices

Construction of a twelve-story downtown office building in Minneapolis is one of the major projects of an eight-million-dollar budget for this year which has just been announced by Robert F. Pack, vice-president and general manager of the Northern States Power Company. Work is to be started on the new structure May 1. It will be built at 21 Fifth Street, South, to make a part of the present structure adjoining at 15 Fifth Street, South, and seven additional stories will be added to the newest five-story unit of the old building. The building is to be ready for occupancy May 1, 1929. The power company will occupy ten floors of the new addition and the remainder will be available for rental to electrical firms.

The second largest item in the 1928 budget is one, already noted, of about $1,500,000 for the completion of the company's hydro-electric plant and dam at Chippewa Falls, Wis. Nearly $1,500,000 has been spent already on this development, which is to be ready for service next September. The program further includes betterments and expansions of both production and distribution facilities in five states—Minnesota, North Dakota, South Dakota, Illinois and Wisconsin. Several new

substations are to be built, and it is estimated that more than 200 miles of cable and conduit will be installed, to replace present equipment and for extensions to the company's lines. In the Minneapolis area heavier cables and larger vaults will be installed in the downtown district and an additional feeder built from the Aldrich Avenue substation to the "Loop" district. In St. Paul a second bank of 15,000-kva. transformers will be installed at the High Bridge plant. Improvements to the electrical systems at Grand Forks, Fargo and Minot, N. D.; Sioux Falls, S. D.; St. Cloud, Stillwater, Mankato and Red Wing, Minn., and Eau Claire, Wis., also figure in the program, and a 35-mile, 11,000-volt transmission line will be built from Clara City to Cosmos, Minn.

Referendum Versus New Power Survey

Partisan Gestures on St. Lawrence Development Indulged in by Both Sides at Albany—Savings Banks Investment Bill Reintroduced

A NEW proposal on St. Lawrence River water power from Governor Smith of New York is now before the Legislature in a bill introduced by the leaders of the Democratic minority to hold a referendum at the general election next fall on the question of whether the state's remaining water-power resources shall be developed by a state Power Authority, as advocated by the Governor, or by private corporations under leases, as urged by the Republicans, who control both houses at Albany.

This proposal has been met by the Republicans by the introduction of a water-power bill along the same lines as one passed by them last year and vetoed by the Governor. It provides for an impartial commission of five members to make a survey of the state's water-power resources and the best method of developing them. It is reported that all the Republican senators have been pledged by caucus action to support this measure.

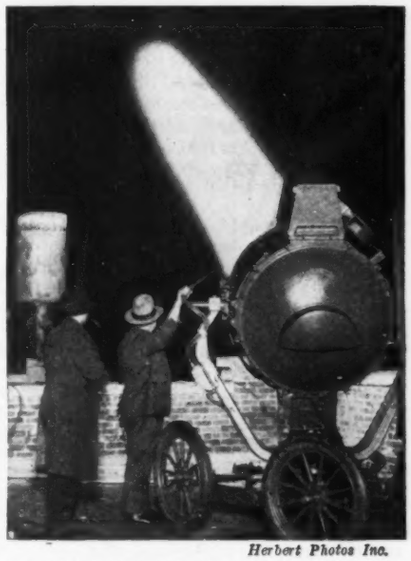
The bill to amend the savings banks investment law so as to permit these institutions to invest in the bonds of certain electric, gas and telephone companies which meet specified requirements has been reintroduced in the Assembly and referred to the committee on banks. This measure was defeated last year in the Assembly by 85 to 49, and so far the prospects for its passage at this session do not seem hopeful.

Assemblyman Hearn of Brooklyn has introduced a bill amending the Public Service Commission law by empowering the commission to require every gas and electric corporation to publish proposed changes in rates in a daily newspaper. At present the only publication, except as news, is by a tariff filed in the office of the corporation which may be inspected by the public.

Under the provisions of a bill introduced by Senator Brereton of Essex County the Public Service Commission law would be amended by giving to the commission supervision over a corporation or person controlling through lease, voting trustees or operating contract a corporation subject to jurisdiction of commission or which furnishes products or service to such corporation for ultimate distribution to the public. A similar bill failed of passage last year.

Beacon Lights of Great Size Continue to Be Installed

An aeronautical beacon of more than 1,000,000,000-beam-candlepower rating is to be placed on a 1,320-ft. tower in the "Loop" district of Chicago, according to Paul Henderson, vice-president and general manager of the National Air Transport, Inc., which operates the Eastern division of the transcontinental air mail between New York and Chicago. Elmer A. Sperry, head of the Sperry Gyroscope Company of Brooklyn, has donated the light to Chicago, and a survey is under way to select the site for the tower, which will be built on one of the high buildings in the "Loop."



Herbert Photos Inc.

AIR BEACON ON HOTEL ST. GEORGE, BROOKLYN, RATED AT 480,000,000 BEAM CANDLEPOWER

The new light will have a lens and reflector 63 in. in diameter and will project a revolving five-foot beam. The power plant, tower and installation of the light will cost about $2,000,000.

A new airplane beacon erected last week on the roof of the St. George Hotel, Brooklyn, has 480,000,000 cp. and is said to be the largest beacon ever built for private use. Two revolving beacons now being erected in California by the Standard Oil Company for the guidance of West Coast fliers develop 10,000,000 cp. each. One will be placed on top of Mount Diablo, 25 miles southeast of San Francisco, at an altitude of nearly 4,000 ft. and will be visible from points within a radius of 100 miles. The other is to be among the Merced Hills in the Los Angeles basin, just north of Montebello. It will be similar to the Mount Diablo installation. The standard revolving beacons on the night air-mail routes in the United States, which are visible for 40 miles or more, are of 2,000,000 cp.

White River Conflict Is Probably Adjusted

Federal Power Commission May Now Act on Application for Plant in Arkansas, but Situation on Missouri Application Is Still Blocked

THE Ozarks Hydro-Electric Company has withdrawn its application to the Federal Power Commission for a preliminary permit covering the 200,000-hp. project on the White River near Cotter, Ark. The commission now is in a position to act promptly on the conflicting application of the White River Power Company. This marks a definite step in a project which has been through many vicissitudes. Since the defunct Dixie Power Company received a preliminary permit for it following the first application made under the water-power act eight years ago. The project is related to that on the upper White River, across the line in Missouri, where the Empire District Electric Company has applied for a license covering an 80,000-hp. project at Table Rock. In this case the commission is withholding action on the application because of the opposition of the authorities of Stone County, Mo. The local officials are insisting that the power company build a bridge, which would cost in excess of $500,000, over its reservoir.

An unfavorable report on the proposed development at Wolf Creek, on the Cumberland River, in Kentucky, is understood to have been approved by the Chief of Engineers. The report is said to indicate that the project is not feasible under market conditions prevailing in the area or likely to prevail for a long period. With this report in hand it is believed that the commission will act in the near future on the application of the Cumberland Hydro-Electric Company proposing the utilization of the power resources of Cumberland Falls—the development that has been so strenuously opposed by those who contend it will mar the natural beauty of the Cumberland Falls.

A license has been issued to Henry V. Gates for a small project on Crooked River in Oregon. The license is of particular importance, however, because it contains a clause subordinating the use of the water to any future irrigation requirement. This is the first time that such a provision has been written into a license.

The Starr-Collinson Packing Company of Portland, Ore., has applied for a minor license for a project on an unnamed creek tributary to North Arm of Moira Sound, Prince of Wales Island, Alaska; the Feather River Trust of San Francisco, Calif., for a minor license covering a project on Dogwood Creek, Plumas County, and the California-Oregon Power Company for a license covering a transmission line 25 miles long from its Chiloquin substation to Fort Klamath.

News from the Dominion

Bill to Prohibit Exportation of Power Introduced at Ottawa—Dispute with Provinces Over Federal Rights Continues—Alarmists Take the Floor

ACCORDING to Charles Stewart, Minister of the Interior, it is the opinion of the Canadian government that export of electric power should be prohibited. The Minister made this statement during a discussion of a bill to regulate the exportation of electric power which is now before the House of Commons at Ottawa. The purpose of the bill is to make the export of electric power subject to an act of Parliament, instead of leaving it in the hands of the government.

At the opening session of the Ontario Legislature Premier Ferguson dealt at length with the dispute between the Dominion and provincial governments over power rights. The reference recently taken by the federal government to the Canadian Supreme Court concerning power rights had been undertaken without consulting the provinces, after it had been agreed at the interprovincial conferences in January that both interests should be consulted on the questions to be submitted, the Premier stated. The questions submitted by the Dominion were vague, indefinite and general, and the Premier doubted if any court would answer them. It came as a distinct surprise to him when the reference was announced.

Quebec power interests have failed in their efforts to secure a measure of relief from the Dominion government in respect to income tax as applied to users of electrical energy in that province. The annual budget of that government has been brought down and there is no provision in it dealing with this question.

To renew public agitation in favor of construction of the Georgian Bay canal as opposed to the St. Lawrence waterway project is the expressed object of the Montreal Chamber of Commerce. This body at a recent meeting decided to study the all-Canadian plan again, to invite an engineer of authority to speak on the subject and to approach members of Parliament. One member said that, whereas the St. Lawrence waterway might cost anywhere from a billion and a quarter to a billion and a half dollars, it was known that the Georgian Bay project would cost only $150,000,000. It would also furnish a million horsepower to Ontario.

An ostensibly serious warning has been sounded by John R. Robinson, editor of the *Evening Telegram*, Toronto, that the Hydro enterprise of Ontario is in grave danger of being absorbed by international capital and private ownership. According to him "the interests" are fighting to remove from their path the "menace" of people's power. Attacking the "electric ring" of the United States and Canada and Sir Herbert Holt, Montreal financier, Mr. Robinson declares: "I fear some of you will live to see the day when the whole Hydro system will be sold out to private corporations."

Another alarmist is James H. Hunter, vice-president of the Engineering Institute of Canada, who urges that control of the Canadian sections of the St. Lawrence River should be kept by Canada and should not be risked in an international arrangement with the United States. Mr. Hunter holds that the upper, or Morrisburg, part of the project could be put through immediately by Canada and 300,000 hp. readily absorbed by the Hydro-Electric Power Commission. The second development, at the foot of the Long Sault rapids, should be undertaken only when Canada can utilize the power to which it would be entitled, about 700,000 hp., he says.

Commonwealth Edison to Spend $27,346,000

All the proceedings of the annual meeting of Commonwealth Edison Company stockholders, held in the Edison Building, Chicago, on Feb. 27, were, as has been the custom for a number of years, broadcast by radio for the benefit of the thousands unable to attend. President Samuel Insull in his official address put the number of stockholders at more than 40,000 and the company's customers at 906,000. Total business in 1927 was $71,629,000. Mr. Insull continued:

We have spent during the year 1927 in additions for plant and distribution system $26,057,000, and we figure it will be necessary to spend in the year 1928 $27,346,000 for the same purpose. Thirty-three per cent of the energy that we put out last year came from our new Crawford Avenue plant. In 1927 the largest turbine we have, at Crawford Avenue, has a capacity of 88,000 kw., and the total capacity of all our stations is 1,042,000 kw. Before this year closes we shall have a turbine in operation at Crawford Avenue station that will have a capacity of 100,000 kw., and we shall have a total station capacity in all our stations of 1,053,000 kw. In 1927 our load factor was 48.4 per cent as compared with 47.9 per cent in 1926. Our total output is about 5 per cent of the total output of electrical energy for the entire United States, figured on the basis of a population of 3,100,000, which is about 2½ per cent of the total population of the United States. It is a very proud boast of the personnel of the Commonwealth Edison Company that it has never raised its rates.

After referring to the change in the company's method of billing for energy consumed, which was explained in the ELECTRICAL WORLD for last week (page 419), Mr. Insull went at some length into the Chicago transit situation, in which the Commonwealth Edison through a subsidiary is interested, and declared: "If I am going to be the subject of constant public attack, I shall personally withdraw from all effort to bring about a merger of the various traction properties and content myself with just looking after your interests in the Chicago Elevated Railways."

Samuel Insull, Jr., was elected as a director to succeed the late Watson Blair.

High-Frequency Freaks

Unusual Results Follow Experiments with a Tube Recently Developed in the General Electric Laboratory at Schenectady

EXPERIMENTS with a new type of high-power short-wave tube recently developed by engineers of the General Electric Company laboratories at Schenectady, N. Y., have produced results of an unusual and decidedly interesting character.

Those in control of the experiments report that meters in adjacent rooms have run wild, that delicate measuring instruments have been twisted or broken, that the new apparatus has emitted a warm glow subjection to which has been followed by increasing pain in limbs and joints, that rats in a cage placed close to the radiating wire have become excessively animated and then, if exposed too long, have died, that a new incandescent lamp has been lighted to full brilliancy without wires or socket, that a cold copper bar lying on the floor has blistered the hand of a man picking it up, that a neon tube has suddenly flooded the room with its glow when merely touched, that simple food has been cooked in a glass tube suspended from a receiving aërial, and that many less spectacular effects have been experienced.

The vacuum tube, 5 in. in diameter and about 2 ft. long, is inclosed in a wooden cage and surrounded by a network of wires, condensers and meters. The tube operates as a self-excited oscillator on a wave length of 6 m. and is capable of radiating from 10 kw. to 15 kw. of high-frequency power—probably fifty times as much as any short-wave tube has heretofore been able to produce. The tube is connected through a coupling system to a copper bar approximately 3 m. long, which constitutes the tuned aërial circuit, and is able to radiate into space the full 15 kw. generated by the oscillator.

Most striking of the short-wave effects was the standing electric arc, a close imitation of the famous ball of fire reputed to accompany tropical thunderstorms. The operator touched the end of the radiating aërial with a metal-tipped pole, and immediately a greenish white arc arose to a height of a foot or more. When the pole was removed the arc remained, like a plume of fire, sputtering and sending molten copper in all directions until blown out. By skillful manipulation as many as three of these arcs were established simultaneously along the aërial, giving the appearance of a row of flaming gas jets. Smaller standing arcs of this nature were established on the ends of a receiving aërial several feet from the radiating system, demonstrating the transmission of power currents through space.

Experiments of the same nature are known to be under way also in the laboratories of the Westinghouse Electric & Manufacturing Company, wave lengths of 1½ m. being employed for the purpose.

Purchases and Mergers

American Gas & Electric Buys Princeton (W. Va.) Power Company—Little Rock Municipal Plant May Be Sold to Arkansas Power & Light

THE American Gas & Electric Company, of which the Appalachian Electric Power Company is a subsidiary, has purchased the electric light and power property of the Princeton (W. Va.) Power Company for a sum said to be around $700,000, and the contract has been ratified by the stockholders of the latter. The Princeton Power Company had divorced its light and power business from the street railway, and all the street-railway property was conveyed to the Tri-City Traction Company, a corporation formed among the old stockholders.

Negotiations for the sale of the Little Rock city power plant, now operated to furnish power for the street-lighting system, to the Arkansas Power & Light Company, provided that company makes a satisfactory rate for street-lighting service, are under way. This plant has been valued at prices ranging from $150,000 to $200,000.

The sale of the Yellville (Ark.) lighting plant to the Arkansas Power & Light Company is thought to be a preliminary step to bids for the smaller plants between Batesville and Yellville, which would give an unbroken chain to the contemplated dam on the White River site which the company bought a year ago. It is reported that negotiations are under way by the Couch interests to buy the plants at Calico Rock and Cotter, but sales are not closed.

Transfer of the capital stock and properties of the Clear Spring Electric Light & Power Company and the Potomac Light & Power Company to the Potomac Edison Company of Hagerstown has been authorized by the Maryland Public Service Commission. For the Potomac Light & Power Company's stock the Potomac Edison paid $106,000, the par value.

Approval of the Maryland commission has also been given to the transfer to the Consolidated Gas, Electric Light & Power Company of Baltimore of all property and assets of the twelve subsidiary companies referred to last week.

The Interstate Public Service Company has filed a petition with the Indiana Public Service Commission asking authority to buy for $97,500 properties in Johnson, Shelby and Bartholomew Counties, with a combined valuation of $110,000. Transmission lines near Columbus, Ind., owned by the H. F. Clevenger Electric Company; the Winterrows transmission lines near Flatrock and the Trafalgar Light & Power Company of Johnson County are the properties.

A special election will be held in Rochelle, Ill., March 26 on a proposal of the Federal Public Service Company of Chicago to purchase the Rochelle municipal electric plant and properties and water system for $500,000.

Purchase of the Adrian, Burnside, Colusa & Ferris Light & Power Company properties in Hancock County, Ill., for $34,050 by the Central Illinois Public Service Company has been authorized by the Illinois Commerce Commission.

Electric transmission lines east from Lake Park to Lake Okoboji, Iowa, have been purchased from the Central States Electric Company by the Northwestern Light & Power Company.

The Otter Tail Power Company has been authorized to purchase the electric property at Wilton, N. D., from the Washburn Lignite Coal Company.

The Western Public Service Company has purchased the municipal lighting plant at Ogallala, Neb. The Iowa-Nebraska Light & Power Company has purchased distribution systems at Burchard and Steinauer, Neb., and a transmission line from Dubois. These towns have been buying from the municipal plant at Pawnee City.

Approval has been granted by the Kansas Public Service Commission for the sale to the Kansas Power & Light Company, Topeka, of the electric distribution system and transmission line of the city of Huron.

The Tennessee Railroad and Public Utilities Commission has approved the purchase by Frank A. Reid from T. G. Avery of the electric distribution system in Halls and Gates and the transmission line connecting the two towns for $52,000.

Negotiations between the Southern Cities Utilities Company of Chattanooga and Tullahoma (Tenn.) representatives for the sale of the municipal electric plant and waterworks at Tullahoma to the company are in progress.

Crystal Springs (Miss.) municipal authorities are considering the sale of the water and light plants for $145,000 cash to Kulley & Williams of Jackson, who have applied for a charter under the name of the Mississippi Utility Company.

It is reported in San Francisco that H. M. Byllesby & Company are negotiating with the Snow Mountain Water & Power Company for the purchase of its properties in the Ukiah and Lake Pillsbury section.

Sale of the Laurentian Power Company to the Quebec Power Company has been approved by the shareholders of the Laurentian. The Quebec Power Company will thus come into possession of a 30,000-hp. development on the St. Anne River, with a 40-mile high-tension line to the city of Quebec.

Senator Walter Schlosser of Grand Forks, N. D., head of the Northern Light & Power Company, has just made an offer of $140,000 to the town of Estevan, Saskatchewan, for the power plant recently erected there. His proposal is to build a central power station at Estevan, using lignite coal for the supply of electric power to southern Saskatchewan.

Program for Policies Division of the N.E.M.A.

Definite action on the matter of an "all-electrical industry show," on tariff matters and on adequate statistics is expected at the spring meeting of the Policies Division, National Electrical Manufacturers' Association, to be held on March 14-16 at the Edgewater Beach Hotel, Chicago. A request for definite support of the program of the Industry Sales Conference will also be presented. N. A. Wolcott, chairman of the N.E.M.A. committee on codes of ethics and sound merchandising principles, will discuss that subject at the first general session. Other speakers scheduled are R. J. Russell, Century Electric Company, who will discuss "Terms of Payment," and W. S. Rugg, Westinghouse Electric & Manufacturing Company, who will talk on "Minimum Standards of Performance for Electrical Products" at the second day's session. "Cost and Channels of Distribution" is scheduled for general discussion following Mr. Rugg's address.

Portland Has Commercial Meeting

Range Sales, Appliance Merchandising and Electric Refrigeration Discussed by Members of the Northwest Electric Light and Power Association

COMMERCIAL leaders of the Northwest Electric Light and Power Association gathered at Portland, Ore., on Feb. 20 and 21 for the annual midwinter meeting of the Commercial Section and, under the chairmanship of J. C. Plankington, discussed reports of the year's work. The lighting committee showed that much is being accomplished in bringing about better lighting in the factory, store, office and home through the presentation of lighting talks and demonstrations before luncheon clubs. Twenty-nine talks in all will be given by the committee this year. Work of the street and highway lighting committee centered on the job of compiling data to show street-lighting costs per capita, percentage of street-lighting costs to police expense, etc., to be used as sales material in the case of municipalities.

A survey made by the commercial cooking committee to determine the cost of electrical energy per unit of output will aid salesmen in obtaining more of this class of business. The competitive power committee found that, even with the very low prevailing prices of wood waste, many woodworking plants are finding it economical to purchase central-station service. Moreover, the increasing use of stoker-fired wood waste in household furnaces is providing a market for wood refuse.

One of the things the electric range committee expects to accomplish is to replace obsolete electric cooking equipment in the domestic science departments of schools and universities with modern equipment. Special sales versus continuous selling came in for considerable discussion, and it was quite generally agreed that the greatest volume of sales will result from following the vogue of the times—the special sale.

Figures compiled by the merchandising committee on sales of small appliances led the committee to conclude that insufficient effort has been placed upon this form of merchandising. Several told of company policies to assist dealers in every possible way to tie in with the central station on appliance sales. A general discussion of electric refrigeration showed that the servicing problem is causing power companies less concern, owing to better product and the larger distributors' policy of maintaining a well-trained and efficient service organization of their own. Some power companies have been successful in establishing a policy of passing service charges on to the customer, and several felt that this is the solution to the servicing problem.

Briefer News

READY TO BUILD MARTIN DAM TRANSMISSION LINE.—By an order of the Alabama Public Service Commission just issued the Alabama Power Company is authorized to construct a transmission line from Martin Dam to the Alabama-Georgia line, a distance of 46 miles. Work will begin in a short time.

NEW SUBSTATION AT PULASKI, VA.—Among structures lately completed by the Appalachian Electric Power Company is the Pulaski (Va.) 7,800-kva. substation, which is fed by two 88-kv. transmission lines, one from Byllesby and the other from Glen Lyn. A 33,000-volt bus feeds three outgoing lines, one extending to Radford and Christiansburg, another serving Dublin, Belspring and several mines, and the third to supply the Empire mines.

"WHITE WAYS" FOR MIAMI AND LITTLE ROCK.—A "white way" is to be installed in the business district of Miami by the Florida Power & Light Company. It will consist of 197 400-cp. ornamental lamps and four of bracket type. A new "white way" installed by the Arkansas Power & Light Company at Little Rock, Ark., on Louisiana Street, comprising 32 ornamental posts surmounted by 1,000-watt lamps, makes that the brightest street in the city.

NORTHWEST ENGINEERING SECTION PROGRAM.—The program for the fifth annual meeting of the Engineering Section, Northwest Electric Light and Power Association, to be held at Spokane, Wash., on March 8 and 9, includes, besides many technical committee reports with a wide purview, addresses by Major H. S. Benion, N.E.L.A., and E. C. Stone, chairman Engineering National Section, N.E.L.A. An illustrated report of the Lake Chelan project will be another item.

CULTIVATING GOOD WILL IN OKLAHOMA.—At another of the "good will" conventions being held by the Oklahoma Utilities Association, Public Relations Division, in various cities of the state—this one in Lawton on Feb. 23—E. R. Ernsberger, president of the association, gave the executive's viewpoint as head of the Southwestern Light & Power Company, and E. F. McKay, secretary of the association, told how that body "ties in." Many utility men took part, and there was a banquet and entertainment in a church dining hall in the evening.

COOPER GETS RIGHTS ON FORK OF COLUMBIA.—Acting under the authority conferred in an Attorney-General's opinion (ELECTRICAL WORLD, Feb. 18, page 370), R. K. Tiffany, State Hydraulics Supervisor, has bestowed Washington water rights for a power development to cost $17,600,000 upon Hugh L. Cooper of New York City. This is the 260,000-hp. "Z" Canyon enterprise, on Clark's Fork of the Columbia River, already described. The power plant, reservoir and impounding dam will all be in the immediate vicinity of Metaline Falls, Wash.

OHIO STATE UNIVERSITY OFFERS TECHNICAL FELLOWSHIP.—The Ohio State University announces the Stillman W. Robinson fellowship, having an annual value of $750, for graduate study and research in electrical, mechanical or civil engineering. Further information may be obtained from the dean of the Graduate School, Ohio State University, Columbus, Ohio.

GROWTH OF SHAWINIGAN SYSTEM.—The annual report of the Shawinigan Water & Power Company refers to an extension of its No. 2 power plant at Shawinigan Falls which will be carried through during 1928 and will add 43,000 hp. to its rated capacity. During the year there were added to the company's systems 82 communities, with an addition of 648 miles of lines, through construction and purchase. Two new customers were the Ste. Anne paper plant at Beaupré and the Anglo-Canadian Pulp & Paper Mills at Quebec City.

MEMPHIS RATES TO BE CUT, BUT HOW?—Negotiations for a reduction in electric light rates that will save some classes of Memphis consumers $90,000 a year have been under way between city officials and the Memphis Power & Light Company. The light company has a surplus of $200,000 over the percentage of profit allowed to it by the state. Under the law it must cut its rates so that its revenues will be decreased by $90,000 each year for the next three years. The question to be settled is whether the saving shall go to the home users or the commercial consumers.

PENNSYLVANIA RAILROAD HAS ELECTRIFICATION PLANS FOR BALTIMORE.—The Pennsylvania Railroad's plans for increased facilities in Baltimore, costing from $22,500,000 to $30,000,000, include electrification of all its lines in the main part of the city, at an estimated cost between $7,500,000 and $15,000,000, and construction of two additional tunnels approximately paralleling the present Pennsylvania tubes under the city. The Baltimore electrification program is distinct from the previously announced plan to electrify the Pennsylvania's main line from New York to Washington.

NEW POWER COMPANY FOR SOUTHERN MARYLAND.—Application for permission to construct an electric power system in southern Maryland to serve communities in St. Mary's, Calvert, Charles and Prince George's Counties where electric service has not existed heretofore has been filed with the Public Service Commission by the Suburban Light & Power Company, an organization of Maryland and Cleveland business men. Either contracts will be made for the purchase of power from Baltimore or Washington utilities or the company will build its own power plant.

PACIFIC GAS & ELECTRIC COMPANY'S 1928 PROGRAM INVOLVES $22,500,000.—The Pacific Gas & Electric Company's construction and maintenance budget for 1928 for additions and betterments to plants involves expenditures in excess of $22,500,000. One of the major activities is the Mokelumne River development, which was described in the ELECTRICAL WORLD for Dec. 31 (page 1367). In Placer and Nevada Counties additions to the Spaulding-Drum developments will be completed, involving the erection of the Spaulding No. 3 plant, a 10,000-hp. unit on Lake Spaulding; the replacing of temporary structures and relining of the Drum Canal, providing increased water capacities, and the installation of a penstock and a

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

American Institute of Electrical Engineers—St. Louis regional meeting, March 7-9; Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11. F. L. Hutchinson, 33 West 39th St., New York.

Northwest Electric Light and Power Association — Engineering Section, Spokane, Wash., March 8 and 9; Accounting Section, Portland, Ore., March 12. Berkeley Snow, 1208 Spaulding Building, Portland, Ore.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Madison, Wis., March 17-18. W. Wilke, 4211 Eiring Place, Milwaukee.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N. E. L. A.—Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

fourth generating unit of 20,000 hp. at the Drum plant near Colfax, which will bring this plant up to an installed capacity of 70,000 hp. In the East Bay territory work will continue on the enlargement of the company's steam-electric plant in Oakland, where, as already reported, a new 37,500-kw. turbine is being installed.

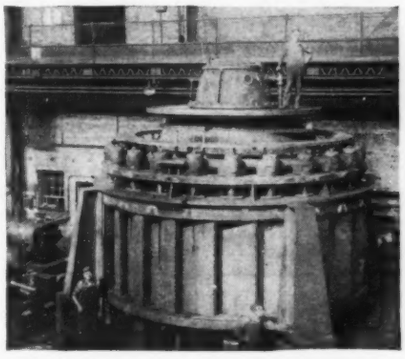
VERMONT ELECTRICAL ASSOCIATION MEETS AT BURLINGTON.—The Vermont Electrical Association held its winter meeting in Burlington on March 1, and members had an opportunity to visit the new hydro-electric plant of the Burlington Light & Power Company at Winooski Gorge. At the banquet H. B. Kinnison, United States Geological Survey, was to talk on "Special Features of the New England Flood of 1927," and M. G. Clark, vice-president of the People's Hydro-Electric Vermont Corporation, was down to give "an executive's viewpoint of problems resulting from the freshet."

KENTUCKY UTILITIES SHUTS DOWN A GENERATING STATION.—The Kentucky Utilities Company has announced the shutdown of the Dorchester generating station of the Old Dominion Power Company, a subsidiary, near Norton, Va., following the addition of a 33,000-volt circuit to its steel-tower transmission line between the Pocket (Va.) generating station and Imboden and the reconstruction of the old circuit. With the improved transmission facilities it was found that the Pocket station could easily carry the increased power load of the Dorchester station and at a reduced cost. The Dorchester plant will be held as an emergency unit.

ELECTRICALLY WELDED RAILROAD BRIDGE READY FOR USE.—An electrically welded steel-truss bridge has been set in place across a canal at Chicopee Falls, Mass., and as soon as flooring and track have been laid it will be in regular use by the Boston & Maine Railroad in moving freight to and from the river plant of the Westinghouse Electric & Manufacturing Company, where large radio transmitters are being produced for naval and marine use. The bridge is 175 ft. long and its weight is 80 tons. It meets the same requirements as a riveted structure of 120 tons and is considered more satisfactory and durable Studies are being made for eight main-line railroads contemplating the use of such bridges, according to Gilbert D. Fish, consulting engineer with the Westinghouse company

IOWA'S CLAIM TO LEADERSHIP IN ELECTRICAL SATURATION.—Production and sale of electrical energy in Iowa during 1927 surpassed all previous records, and figures from the Geological Survey reports quoted by Joe Carmichael at the Iowa Power Conference put the total excess for last year over 1926 at almost 60,000,000 kw.-hr. Production for 1927 was approximately 1,403,684,400 kw.-hr. Iowa claims to be the most thoroughly electrified state. Electric service is now available to 99.7 per cent of her urban population, the estimate says. She has approximately 11,000 miles of transmission lines, and during 1927 the State Board of Railroad Commissioners granted franchises for the construction of 827 miles, and county boards of supervisors for the construction of 188 miles. Of the 922 cities and towns in Iowa, 884 have electrical energy available. Those not served have populations under 400.

RECORD-BREAKING TURBINES FOR CONOWINGO.—Unprecedented in physical dimensions, according to the manufacturer, the Allis-Chalmers Manufacturing Company, the four 54,000-hp. hydraulic turbines built for the Conowingo development of the Philadelphia Electric Company, two of which are already installed, have many points of interest. They will operate at a speed of 81.8 r.p.m. under a normal head of 89 ft. The turbines are single-runner, vertical-shaft type with steel-plate spiral castings. The cast-steel runners have an over-all diameter of 17 ft. 9 in. and weigh approximately 100 tons each. The butterfly valves have a diameter of 27 ft.



PHILADELPHIA SUBURBAN-COUNTIES TO EXPAND BARBADOES ISLAND PLANT.—The Philadelphia Suburban-Counties Gas & Electric Company will spend more than $6,000,000 during the current year for plant extensions and improvements, according to an announcement made by H. H. Ganser, vice-president and general manager of the company, which is a subsidiary of the United Gas Improvement Company. Contemplated improvements in the electric department include the expansion of the Barbadoes Island power plant in the Schuylkill at Norristown, additional facilities at various substations throughout the territory and numerous power-line extensions to tie in the system.

NEW YORK CITY'S THREE COMING 160,000-KW. GENERATORS.—The next twelve or fifteen months will see an increase in the generating machinery serving the New York Edison and United Electric Light & Power companies in the Manhattan and Bronx boroughs of New York City of 50 per cent. This will be brought about by the installation of three 160,000-kw. generators, two at the Hell Gate and one at the East River station. Thus the rating of Hell Gate, now 285,000 kw., will increase to 605,000 kw. and that of East River, now 120,000 kw., to 280,000 kw. The entire system will go up from 925,000 kw. to 1,405,000 kw.

COMING HYDRO DEVELOPMENT NEAR OGDENSBURG, N. Y.—The St. Lawrence Valley Power Corporation will begin extensive developments at the Eel Weir, about five miles from Ogdensburg, N. Y., about April 1, according to an announcement made by F. A. Stoughton, president of the corporation, which purchased the Eel Weir some months ago. A concrete dam 14 ft. high will be built, also a large power house of the three-unit type, the turbines for which have already been ordered. The total capacity will be 3,000 hp. The company has the right-of-way from Eel Weir direct to Ogdensburg. Sept. 1 is set for the completion of the work.

CALIFORNIA-OREGON SUING TO GET FORT KLAMATH TERRITORY.—The Oregon Public Service Commission is the defendant in a suit by the California-Oregon Power Company to set aside an order of the commission (ELECTRICAL WORLD, Dec. 17, page 1270) which gives to the Wood River Power Company the exclusive right to furnish light and power to Fort Klamath on the ground of priority. This suit is the outcome of a long and bitterly contested controversy. The California-Oregon company claims that it was first in the territory by reason of negotiations with prospective customers and the government long prior to the existence of the Wood River Power Company. The suit raises the question of the comparative importance of a blanket franchise granted by a county court and a certificate of convenience and necessity.

MANHATTAN (KAN.) VOTERS DEMAND LOW RATES.—Refusing by a vote of three to one to renew the franchise of the United Power & Light Corporation, despite an accompanying rate reduction of about 15 per cent, citizens of Manhattan, Kan., through the City Commission, have served notice on the company that franchise negotiations will not be reopened until still lower rates are offered. Unless such rates are offered "within a reasonable length of time," the city will petition the state commission for them. The proposed franchise had been recommended by the City Commission and Mayor, a special franchise committee, the Chamber of Commerce and leading newspapers. The company has also prepared reduced schedules for Salina and is doing so for Junction City.

ELECTRIC-STEAM GENERATOR INSTALLED AT LEWISTON, ME.—Lewiston, Me., now boasts an electric-steam generator installed by the Central Maine Power Company at its steam plant there to utilize surplus hydro power from Gulf

Island. The boiler is 66 in. in diameter, 19 ft. over all and contains 72 steel tubes 3 in. in diameter by 16 ft. in length. The boiler was constructed for a working pressure of 125 lb. and is rated at 1,200 kw. The electrical equipment, furnished by the General Electric Company, consists of 144 heating units, four control panels and four pressure governors. The boiler is designed for a 440-volt, three-phase circuit. The energy is furnished by two 600-kw., 10,000/460-volt transformers outside the boiler room. It furnishes heat to the plant itself, the company's office building and storeroom, a hotel and a theater.

STONE & WEBSTER OPEN OFFICE IN PARIS.—An office for investigation and valuation of utility companies, industries and governmental and municipal projects for American bankers and investors has just been opened at 2 Rue des Italiens, Paris, by Stone & Webster, Inc. James F. Case, who has had engineering and financial experience in Europe, South America, China, the Philippines, Canada and Cuba, will be in charge. He was chairman of the American delegation to the French International Engineering Congress, which studied plans for restoring the French devastated regions. He resigned from Ulen & Company, New York, which has affiliations with Stone & Webster, on Feb. 1.

CALIFORNIA RAILROAD COMMISSION TO INVESTIGATE RATES OF LOS ANGELES GAS & ELECTRIC.—The California Railroad Commission has instituted an investigation into all electric rates charged by the Los Angeles Gas & Electric Corporation in the city of Los Angeles and vicinity. This action is the result of the company's filing a revised schedule of rates applicable to street-lighting service and embodying a reduction from 4 cents a kilowatt-hour to 3 cents. This circumstance, the commission held, invited an investigation into the company's other rates for electric service. Its order brings the rates of virtually all the larger utilities of California before it for investigation or action in some form or another.

WORK ON NEW HOLTWOOD PLANT TO START IN APRIL.—Construction of the thirty-million-dollar hydro-electric plant on the Susquehanna River at Safe Harbor, Pa., 9 miles above the present Holtwood plant and about 25 miles above the Philadelphia Electric Company's Conowingo dam, will be started in April by the Pennsylvania Water & Power Company. Final plans are rapidly nearing completion and bids will be asked soon. It is generally expected that the successful bidder will be the Arundel Corporation of Baltimore, builder of the Conowingo plant. The company has executed with the Consolidated Gas, Electric Light & Power Company of Baltimore a new 43-year agreement covering the use of the Pennsylvania company's power and other facilities in Maryland by the Baltimore central station.

DEEPWATER PLANT TO OPERATE ENTIRELY ON 1,200-LB STEAM.—The generating station to be built at Deepwater, N. J., opposite Wilmington, Del., by the American Gas & Electric Company and the American Electric Power Corporation (Stevens & Wood, engineers), which will have an initial generating capacity of 118,500 kw., will have its entire steam demand supplied by high-pressure boilers. There will be two main cross-compound turbine sets, each rated at 54,000 kw. Each set will consist of a 12,500-kw. high-pressure unit operating at 3,600 r.p.m. and a 41,700-kw. low-pressure unit operating at 1,800 r.p.m. The initial steam conditions will be 1,200 lb. gage pressure and 725 deg. F. total temperature. A third high-pressure single-cylinder turbine of 12,500 kw. will be installed and will operate non-condensing. The turbines, generators and exciters will be manufactured and installed by the General Electric Company, which says that Deepwater will be the first central station to operate entirely on a pressure of 1,200-lb. steam.

Recent Court Decisions

ORAL PERMISSION OF HUSBAND FOR ERECTION OF POLES ON WIFE'S PROPERTY ACCEPTED AT COMPANY'S RISK.—Asserting that he had falsely represented himself as his wife's agent and granted oral permission to the Legget Electric Company to erect poles on her land which she afterward forced the company to remove, suit was brought by the latter against the husband for damages based on the alleged deceit (Legget Electric Company vs. Morrison). The North Carolina Supreme Court sustained judgment in favor of the defendant, holding that since the company knew the wife to be the owner, its proceeding to erect the poles without her written authority was at its own risk. (139 S.E. 455.)*

RESPONSIBILITY OF POWER COMPANY FOR INJURIES DUE TO EXPLOSION IN MANHOLE.—The Supreme Judicial Court of Massachusetts found, in Tucker vs. Haverhill Electric Company, that a power company is not liable for injuries resulting from an explosion in a manhole by which the cover was thrown up, the accident apparently being caused by excessive rainfall accumulated in the manhole, unless it had failed to perform some duty which prudence and reasonable care imposed upon it. So finding, the court sustained instructions in the trial court which relieved the Haverhill company from liability because of alleged negligence in failing to prevent the accumulation of water, to inspect the manhole before heavy rain or to provide it with a drain or a secure cover. Where it could not be shown that the explosion would not have happened without the power company's fault the Supreme Court declared, the doctrine of *res ipsa loquitur* ("the thing speaks for itself") did not apply. (159 N.E. 447.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

COLORADO MUNICIPAL PLANT FORBIDDEN TO SEEK BUSINESS OUTSIDE CORPORATE LIMITS.—The Colorado Public Utilities Commission has denied the municipally owned plant of Loveland permission to sell electricity to customers outside of the corporate limits of that city. The manager of the Loveland plant was said to be encroaching upon the territory served by the Public Service Company of Colorado. It will be recalled that after considerable litigation the city of Loveland about three years ago gained the right to condemn the Public Service Company's plant in Loveland and add it to the municipal electric system of the latter city.

COMMISSION'S JURISDICTION NOT TERMINATED BY SIMULTANEOUS COURT ACTION.—The Clear Creek Power & Development Company complained that in making certain orders connected with alleged invasion of its territory the Colorado Public Utilities Commission was exceeding its jurisdiction. In answer the commission maintained (1) that in a proceeding commenced by filing a complaint against an electric utility alleged to be invading the territory of another company the commission may determine a question raised by an answer asking alternative relief, namely, whether in the event the defendant is not entitled to operate in the vicinity a certificate of public convenience and necessity should be issued to it authorizing such operation; (2) that the commission has jurisdiction to determine the questions raised by a complaint against an alleged invasion of territory by an electric utility and, if the facts should warrant, to grant relief; (3) that a company complaining to the commission against an alleged invasion of territory and also going into a court of equity to secure a temporary injunction to maintain the *status quo* does not by this procedure terminate the jurisdiction of the commission over the complaint.

UNIFORM RATES SET UP FOR RIVAL MUNICIPAL AND PRIVATE PLANTS.—The municipal plant of Logan City, Utah, and the Utah Power & Light Company are rivals in the light and power business in the city named. In March, 1927, the Utah Public Utilities Commission brought about between them an understanding that both should abandon flat-rate service, install meters and serve their respective consumers on meter rates. The city proceeded to install meters, but again came before the commission to aver that the company had failed to do so and continued to serve its patrons at flat rates, which the city alleged to be unreasonable, discriminatory and in violation of the public utilities act. The company filed objections to the complaint to the effect that its purpose was not to procure reasonable rates to be charged by both plants, but to compel the company to establish rates higher than those established by the city, and that the order applied for would deny the defendant equal protection of the law and its constitutional rights. As an outcome of the above complaint and counter-complaint, the Utah commission has ordered both plants to serve their customers upon a meter basis for a test period of one year at substantially the uniform meter rates charged throughout the state by the Utah Power & Light Company.

News About Men of the Industry

Greenwood Heads N.E.L.A. Commercial Department

C. Ernest Greenwood of the Edison Electric Illuminating Company of Boston has been appointed director of the newly created commercial department of the National Electric Light Association and will join the headquarters staff March 15. The new department is to function under the direction of the Commercial National Section in an advisory capacity on commercial and merchandising problems confronting electric light and power companies. Mr. Greenwood has always been a resident of Boston. Shortly

C. E. GREENWOOD

after his graduation from Harvard he entered the commercial department of the Boston Edison Company and later served in the statistical department on rate analysis problems. He then represented his company in negotiations for service to new buildings and isolated plants and in 1916 was appointed superintendent of the appliance department. Since that time he has specialized in public utility merchandising.

He has for years been active in the work of the National Electric Light Association on the merchandising, refrigeration, range, commercial cooking and promotional rates committees. He was vice-chairman and chairman of the merchandising bureau in 1921 and 1922 and served for two years as chairman of the appliance department of the joint committee for business development. For the last two years Mr. Greenwood has been chairman of the general merchandising committee and inaugurated the Intertrade Conference. He has devoted much of his time to trade relations and co-operative merchandising with dealers. Incident to his other duties he has been editor of *Edison Life*, the employee publication of the Boston Edison.

ARTHUR B. LISLE, formerly general manager of the Narragansett Electric Lighting Company, Providence, R. I., has been elected president of the New England Water, Light & Power Associates, a newly chartered organization controlling the Central Connecticut Light & Power Company and a number of water companies located in various parts of New England. Mr. Lisle recently became president of the Central Connecticut Company, and will continue to make his headquarters at Providence.

HOBART BERESFORD has been appointed agricultural engineer of the Idaho Power Company, Boise, Idaho.

GERARD SWOPE, president of the General Electric Company, returned from Europe Feb. 27 aboard the *Leviathan* after a short sojourn abroad.

PHILIP GOSSLER, president and chairman of the board of the Columbia Gas & Electric Company, New York, sailed for Cuba last week on the *Munargo*.

JOHN J. O'BRIEN, president of the Byllesby Engineering & Management Corporation, Chicago, has been elected a member of the board of directors of the Harris Trust & Savings Bank, Chicago.

JOHN W. STORRS, a member of the New Hampshire Public Service Commission, has been named chairman of that body to succeed the late William T. Gunnison. M. M. MORSE of Berlin, N. H., has been appointed by Governor Spaulding a member of the commission to fill out the unexpired term of Mr. Gunnison.

THOMAS W. MARTIN, president of the Alabama Power Company, has been elected a member of the board of trustees of the George Peabody College of Nashville, Tenn. Peabody College is an institution for the training of school teachers.

GUGLIELMO MARCONI has been invited by Premier Mussolini to assume the presidency of a committee for the organization of an Italian National Research Council. Such a council has been in existence since 1921, but on account of its peculiar organization it has not been able to obtain satisfactory results. The new council will be a permanent consultative and informative organ of the government concerning the development and progress of scientific activity at home and abroad.

D. EDGAR MANSON has been elected president of the Gloucester (Mass.) Electric Company, which utility was recently acquired by Charles H. Tenney & Company. Mr. Manson is an executive of several other utilities in the Tenney group. Other officers elected were: Albert B. Tenney, vice-president; Elihu A. Bradley, treasurer; Rockwell C. Tenney, assistant treasurer. W. L. Brown, Jr., who has been with the Gloucester Electric Company for the past twelve years, will continue to act in the capacity of manager.

Julian C. Smith New President of Canadian Institute

Julian C. Smith, vice-president and general manager of the Shawinigan Water & Power Company, Montreal, Que., was installed as president of the Engineering Institute of Canada for 1928 at the Institute's recent annual convention. Mr. Smith has been an outstanding figure in engineering circles in Canada for a number of years, though an American by birth. Elmira, New York, is his native city and Cornell University his alma mater. He began his business career as draftsman with Wallace C. Johnson, consulting engi-

J. C. SMITH

neer, Niagara Falls, N. Y., and when Mr. Johnson removed to Shawinigan Falls, Que., Mr. Smith accompanied him in the capacity of assistant engineer.

It was in 1903 that he threw in his lot with the Shawinigan Water & Power Company, when he became superintendent, advancing to the position of general superintendent three years later. Subsequently he was named general superintendent and chief engineer and in 1913 he was made vice-president. At present, in addition to being vice-president and general manager of the Shawinigan company, he is vice-president of the Dominion Engineering Works, Lachine; president of the Quebec Power Company and of the Montreal Tramways and a director of the Dominion Bridge & Laurentide Power Company and of the Montreal Light, Heat & Power Consolidated. Mr. Smith is a member of the British Institution of Electrical Engineers, the American Institute of Electrical Engineers and the American Society of Civil Engineers.

WILLIAM LAWYER HINDS of Syracuse, N. Y., was elected a director of the New York Telephone Company at the meeting of the board held Feb. 23. Mr. Hinds is vice-president of the Crouse-Hinds Company of Syracuse,

manufacturer of electrical supplies, and is also a director of the First Trust & Deposit Company, the Syracuse Savings Bank and the Onondaga Pottery Company of Syracuse. He is also a member of the Syracuse Chamber of Commerce.

R. C. HENDRICKSON has been appointed superintendent of transmission lines of the New York Power & Light Corporation.

STANLEY W. STODDARD has been appointed assistant electrical engineer of the New England Power System. A native of Massachusetts and a graduate of the University of Maine, Mr. Stoddard has been identified with the New England Power System since 1920, when he entered its employ in the capacity of electrical designer. Formerly he had been identified with Stone & Webster at Boston and with the H. M. Hope Engineering Company. About four years ago Mr. Stoddard was transferred from the drafting room to the electrical engineering office.

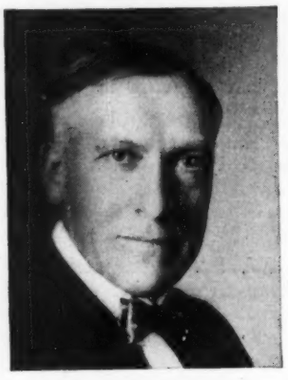
WILLIAM O. WOOD, widely known in the public utility industry, has just been elected vice-president of Waterbury Cable Service, Inc., New York and Chicago. The Waterbury organization is active in the field of underground cable installation and in street lighting, as well as in furnishing special supplies and accessories necessary to this type of installation. Mr. Wood has for many years past been identified with railroads and electric railways in New York, the South and the Middle West, having been for fifteen years president and general manager of the New York & Queens County Railway Company.

WILLIAM STEPHEN HART has been made a vice-president of the Shawinigan Water & Power Company, Montreal, Que. Mr. Hart has been for some years treasurer and director of the Shawinigan company and a director of subsidiary companies. He is a treasurer and a director of the Quebec Power Company and Quebec Railway, Light, Heat & Power Company. Born at Foxborough, Mass., in 1878, Mr. Rart was educated at the Massachusetts Institute of Technology. He took up his residence in Canada in 1903, and in that year joined the Shawinigan Water & Power Company as accountant. He was made secretary in 1906, treasurer in 1912 and director in 1916.

WILLIAM L. ABBOTT, chief engineer of the Commonwealth Edison Company, Chicago, was the guest of honor at a dinner given at the Palmer House Feb. 14, the occasion commemorating Mr. Abbott's birthday. More than a thousand friends were present and Louis A. Ferguson, toastmaster, read letters and telegrams from many others who were unable to attend. Addresses were made by Samuel Insull, Col. Peter Junkersfeld and Dr. David Kinley. At the close of the speeches Mr. Ferguson presented to Mr. Abbott a silver service as a remembrance of the happy occasion. Mr. Abbott has been affiliated with the Commonwealth Edison Company for 42 years.

W. C. Hornberger Vice-President of Arizona Utility

William C. Hornberger, a public utility man of wide experience, who has been prominently identified with the rapid development of Arizona, became vice-president and general manager of the Arizona Edison Company Feb. 1. The Arizona Edison Company is a subsidiary of the Peoples Light & Power Corporation. Mr. Hornberger's record in the industry shows that he is eminently fitted for his new position. He is a native of Michigan and a graduate of the University of Michigan. Following graduation he was associated for a while with a firm of consulting engineers in Detroit and then went to Phoenix, Ariz., where in 1902 he became connected with the Phoenix Light & Fuel Company, now the Central Arizona



W. C. HORNBERGER

Light & Power Company. Beginning work as a switchboard wireman, Mr. Hornberger was steadily promoted to higher positions, in later years becoming successively general superintendent, assistant secretary and assistant general manager of the Central Arizona Light & Power Company. He has held the last-named position for the past eight years. Mr. Hornberger is a director of the Pacific Coast Gas Association, president of the Arizona State Utilities Association and president of the Salt River Valley Electrical League.

W. R. MCGEACHIN, who has been serving as contract engineer and rate manager for the Iowa-Nebraska Light & Power Company, has been advanced to the position of assistant general manager to Frank H. Brooks, vice-president in charge of operation. Mr. McGeachin is a graduate of the University of Nebraska and for eleven years was in charge of government electrical development in the Philippines, serving as manager of the Manila electrical system. He served in the World War in France as a captain of engineers, and after his return entered the service of the Iowa-Nebraska company. He has served in various capacities in Missouri, Iowa and Nebraska. Other changes in the headquarters staff include the promotion of OTTO R. MALLAT, assistant to the manager of the Lincoln district, to the position of assistant secretary, and the naming of B. H. CONLEE, formerly manager of the Beatrice district, to the place of general contract representative.

Obituary

EDWARD MCDONALD, formerly plant superintendent of the Nebraska Power Company, died Jan. 11 in his 59th year. Mr. McDonald had been affiliated with the company for more than ten years.

WALTER BAUER, president of the Pyrene Manufacturing Company, Newark, N. J., died Feb. 12 in his 44th year. A native of Fort Wayne, Ind., Mr. Bauer became identified with the Fort Wayne Electric Company and later with the General Electric Company. Following this connection he was appointed general manager of the American Eveready Company. After serving for two years as vice-president and general manager of the American Chicle Company, he was named president of the Pyrene Manufacturing Company in 1918, the position he occupied at the time of his death. Mr. Bauer was president of the Fire Equipment Institute for several years.

CHARLES P. HUGO SCHOELLKOPF, a member of the firm of Schoellkopf, Hutton & Pomeroy, Inc., bankers of Buffalo, and vice-chairman of the board and a member of the executive committee of the Niagara Falls Power Company, died Feb. 14 in the Lenox Hill Hospital, New York, after an illness of eight weeks. For many years Mr. Schoellkopf was vice-president of the Niagara Falls Power Company, but he retired from active business several years ago. He was a former treasurer of the Shafer Decker Company of Buffalo and a director of the Buffalo, Niagara & Eastern Power Corporation and the Marine Trust Company of that city. He had large mining interests in Mexico and was connected with many other business enterprises.

GEORGE URBAN, JR., 77 years old, one of the early pioneers in the electrical development of the Niagara Frontier, died at his home, near Buffalo, Feb. 23. He was ill but three weeks. Mr. Urban was born in Buffalo in 1850. Many years ago, attracted by the practical possibilities of electricity, Mr. Urban journeyed to New York to interview a rising young inventor, Thomas A. Edison by name. The result of the interview was that Mr. Urban returned to Buffalo with a small electric generator, one of the first Edison built. This generator, now in the possession of the Buffalo General Electric Company, was the first electrical machine in Buffalo. Mr. Urban was vice-president and director of the Buffalo General Electric Company, president and director of the Niagara Electric Service Corporation and a director of the Buffalo, Niagara & Eastern Power Corporation.

Financial and Statistical News

Stocks Remarkably Firm Levels Changed Little Recalls 1926 Break

THE recent stock market decline presents an interesting parallel to that which swept averages down in all markets two years ago. In the case of the power and light stocks, however, federal investigation notwithstanding, the decline has been much less severe and the recovery more prompt.

It is impossible to state definitely that any one factor, such as the investigation, has had any effect. There are two other powerful factors, the general condition of the market and the Federal Reserve policy of tightening money rates. It is a rather remarkable evidence of the strength of these issues that the combination of factors referred to has had so little effect. In fact, a representative group of fifteen common stocks of companies having more than one-third of the total assets of the industry show a gain this week of more than one point on the average. Montana Power is again over 160, against a recent low of 147. Brooklyn Edison is 227, against a low for the year of 206¾. Detroit Edison is more than ten points above the low this year to date. American Gas & Electric Company is over 129, against a recent low of 117½.

These few examples are more or less representative of the more active stocks. There is another large group of inactive issues, but it is impossible to find any substantial number that are materially below levels of a couple of months ago.

Middle West Utilities to Issue Common Stock

Directors of the Middle West Utilities Company have voted to offer additional common stock to all stockholders at $110 a share in the ratio of 10 per cent of holdings. Rights to stockholders of record March 2 will expire May 15.

New England Utility Associates Organized

Formal organization of the New England Water, Light & Power Associates has been completed at Boston, Mass., under the auspices of the banking house of Pearson, Erhard & Company. The associates constitute a holding company which has acquired control of various water supply properties in Rhode Island and Massachusetts and also the Central Connecticut Power & Light Company, East Hampton, Conn. The officers of the trust are Arthur B. Lisle, president, and Clarence I. Worcester, vice-president. It was voted to issue $1,450,000 of 5½ per cent collateral twenty-year lien bonds and $750,000 in 6 per cent preferred stock of $100 par value. Two classes of common stock, "A" and "B," will also be issued, but will not be offered to the public. The properties merged now represent a total of about $4,000,000 from the investment standpoint.

NEW YORK UTILITY REDUCES CAPITAL.—The Orange & Rockland Electric Company has filed a certificate in the office of the Secretary of State reducing its capital stock from $6,000,000 to $5,000,000 and changing par value of shares from 45,000 shares preferred stock $100 par value, 20,000 shares preferred $25 par value and 10,000 shares common $100 par value to 50,000 shares $100 par value. The company's headquarters are at Monroe

Pacific Gas Capital Increased $240,000,000

The Pacific Gas & Electric Company stockholders at a special meeting voted an increase in capitalization by $240,000,000, making total new capitalization $400,000,000. Under the plan, $80,000,000 in common stock was increased to $200,000,000 and $80,000,000 in 6 per cent preferred to $140,000,000. Two additional classes of preferred stock consisting of 5½ per cent and 5 per cent in the sums of $40,000,000 and $20,000,000 respectively were created. Such action was prompted by the fact that only $1,000,000 in preferred stock remained for sale. Original capitalization was $160,000,000, consisting of one-half common and one-half 6 per cent preferred.

Regulation Discussed in Massachusetts Hearings

Attwill's Arguments in Favor of Bill to Insure Jurisdiction by Contract Between Commission and Companies—Some Utilities Attacked Because of Rate Policies

CHAIRMAN HENRY C. ATTWILL of the Massachusetts Department of Public Utilities severely criticised the rate and dividend policies of a number of power companies in the state when recently addressing the legislative committee on power and light in support of a bill to strengthen the regulative powers of the commission. The proposed regulative contract with the state which the bill forces upon the companies under penalty of increased municipal competition, loss of the right of eminent domain and estoppal of capital expansion and the summarized arguments for and against this measure presented at the hearings have been briefly outlined in the news columns of the ELECTRICAL WORLD. In view of the widespread interest manifested in the industry and by publicists in the regulative situation in Massachusetts as it has been affected by the appeals of the Worcester and Cambridge Electric Light companies to the federal courts against recent orders of the board reducing rates from 7 to 5 and from 8 to 5.5 cents per kilowatt-hour respectively, extracts from Mr. Attwill's argument for the bill are printed below. In a later issue the major points of opposition made by the companies will be published. Mr. Attwill's defence of the bill follows:

This recommendation is made by the department with no hostility to the conduct of gas and electric companies by private capital, subject to state regulation. Some of the regulated and protected monopolies in this state resent the thought that rates should be made reasonable and that the public should share in their prosperity. All the members of the department, I think, believe that the principle of regulated monopoly as heretofore obtaining in Massachusetts cannot prevail and that the public will be forced into public operation of the electric utilities unless some means can be advanced by which the greed of some of the electric companies can be curbed. To our minds it is obvious that these utilities cannot continue to boast of their ability to serve the public better and to furnish service at cheaper rates than the public can do itself unless at least some of them approach the efficiency of public-operated utilities of like character and furnish service at somewhere near the rates which the publicly owned plants have shown in this state. . . . If there are no companies in this state operated by private capital which can approach a rate which the Holyoke municipal plant is now giving, and making also a handsome return upon its investment, then it seems to me that the field of the private utility is gone in this Commonwealth, or I mistake very much the temper and the character of the people of the state.

Our suggestions are in no way directed at those utilities which try to do the honorable thing, and which recognize that they owe some duty to the Commonwealth and to their fellow man, but we have got to a place here in the Commonwealth where if what they say is true, if the situation in which the Commonwealth and the people find themselves, according to their theories and assertions, is true, then regulation in Massachusetts in so far as rates are concerned is no longer effective. . . . Constitutional law is largely determined in the last analysis by public sentiment. A true doctrine of public opinion, a true economic theory will never be stopped by any decision of any court in this land. . . .

The battle to free the slaves was not stopped by any decision of the Supreme Court, notwithstanding the Supreme Court in the Dredd Scott case said that it was unconstitutional to free the slave.

After discussing various instances, Mr. Attwill said:

Now I think here in Massachusetts, where, as I recall it, the torch was first raised for liberty of opinion, where was first raised the torch of assault on human slavery, we ought not to be timid in asserting the right that when we grant to a monopoly the right and the power to carry on what I believe to be a state and government function, when we grant and farm out that right to some corporation, that we have the right to impose conditions upon that corporation as to how it shall conduct that governmental function which we have intrusted to it. . . . We are asserting here the principle that the time has come when we should tie up the power to regulate rates as the part of the charter of each of these corporations, the same as we have done time and time before, the same as we did when we granted the Elevated Railway the right to build its elevated structures in the city of Boston. We then said, "You shall charge so much, and no more." Many are the instances of toll bridges being erected in this Commonwealth and throughout New England where they have said exactly the same thing.

The first section of the bill provides that the gas and electric companies may readjust their stock so that the premiums and any profits that they have not withdrawn, up to 7 per cent on an average since their existence, may also be capitalized; that by that adjustment and by that rearrangement of stock they agree with the Commonwealth that there shall be an amendment to their charter to the effect that they shall thereafter be subject to such rates and charges as the Commonwealth may prescribe, subject, however, to the condition that the Commonwealth shall never again prescribe rates which will prevent them from paying dividends sufficient and adequate to maintain their stock at par.

When we guarantee, in effect, a public utility corporation—as we do in this Commonwealth, in a sense—against loss, because everybody must recognize that in a way the statutes of this Commonwealth at the present time provide that no stock can be issued except at par, we have got to maintain the credit of that company at all times, so that its stock will sell at par, in order that it may be able to get the capital needed to make extensions and improvements which the public service may require.

Now, as a practical matter we give them a monopoly of operation; we in effect guarantee the integrity of their stock, and it would seem that we ought to receive some consideration in exchange for those wonderful privileges that we give them.

Think of it, under Massachusetts rules, the rules we have had here, the war came on and these companies expected that they would be allowed by the department to increase the tax upon the public to preserve the integrity of their investment. Which was done! In largely every instance relating to gas and electric companies you will find that when they asked for an increased rate to preserve the integrity of their investment during the war it was allowed; they levied that burden upon the public, and they received the privilege of doing that very thing. Now, after the war is over and they are prospering and taking exorbitant profits, they decline to divide with the public, and they intrench themselves behind this alleged right to practice extortion and corporate greed upon the public of this Commonwealth.

Now, I am not saying that this applies to all of the companies. It certainly does apply to some of them. And if the Commonwealth of Massachusetts is to receive no relief otherwise, there has got to be some legislation of this sort or the only recourse is to go into public operation and ownership of these utilities.

That is all there is to the bill. We say to the corporations that are unwilling to do that, "Very well; you cannot, then, expect the Commonwealth to protect you from competition. You cannot expect that the cities and towns and the people of the cities and towns before they can go into business

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Feb. 28	Low 1928	High 1928
ABITIBI PWR. & PAPER, com., new — no par	74	72	81
Ala. Pwr., $7 com. pf.—no par	114½	114½	115½
Allis-Chalmers Mfg.,6% com.	119	115½	125
Aluminum Co. of Amer., com.	k127	120	136
Aluminum Co. of Amer., 6% pf.	106½	105½	107½
Amer. & Foreign Pwr., 7% pf.—no par	107	105	108
Amer. & Foreign Pwr., com.—no par	23	22	27
Amer. Bosch Magneto, com.—no par	16	15	22½
Amer. Brown Boveri Elec.†	15	14	18
Amer. Brown Boveri Elec., pf. $7	k 57	55	63
Amer. Gas & Elec., 6% pf.—no par	107½	106½	109
Amer. Gas & Elec., com. †—no par	129½	117	131½
Amer. Lt. & Trac., 6% pf.	115	116	120
Amer. Lt. & Trac., new com.	k184	170	191
Amer. Pwr. & Lt., 6% pf.	106	104	109½
Amer. Pwr. & Lt., com. †—no par	66½	62½	69½
Amer. Pub. Serv., 7% pf.	a100	99	100
Amer. Pub. Serv., com. †	k 70	70	75
Amer. Pub. Utilities, 7% pfc. pf.	90	90	93
Amer. Pub. Utilities, 7% pr. pf.	100	98	100
Amer. Pub. Utilities, com.	k 60	60	65
Amer. States Sec., A	a 5	4	5½
Amer. States Sec., B	a 6	4½	6
Amer. Superpwr., 6% pfc pf.—25	30	28½	30
Amer. Superpwr., 6% 1st pf.	l 103½	....	....
Amer. Sup'pwr., Class A†—no par, ex. rts.	k38½	37	41½
Amer. Sup'pwr., Class B†—no par, ex. rts.	38½	37½	43
Amer. Wtr. Wks. & Elec., 6% pf.	k103	101½	105
Amer. W.W. & E., com. new—no par	53½	52½	61
Anaconda Copper cap. $3	54½	53½	59½
Appalachian Electric Pwr., 7% pf.	109	108½	109½
Arkansas Pwr. & Lt. 7% pf.	107½	108	109½
Assoc. Gas & Elec., $3.50—50	54	....	....
Assoc. Gas & Elec., pf.—$6—no par	95	96	98½
Assoc. G. & E., Class A, 10—no par.	47½	47	51½
BABCOCK & WILCOX, 7% com.	120	120	124½
Binghamton L., H. & P., $6 pf.	105½	102	105½
Birmingham Elec., pf.—$7—no par	110	109½	111
Blackstone Valley G. & E., 6% pf.	k107	109	112
Blackstone Valley Gas & Elec., 10% com.—50	140	132	143½
Blaw-Knox, com.†	k103½	91	105
Brazilian Trac., Lt. & Pwr., $7 com.	f199½	....	....
Brazilian Trac., Lt. & Pwr.,com.,new	f 51½	....	....
Broad River Pwr., 7% pf.	105	105	107½
Brooklyn Edison, 8% com.	227	206½	235½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	k 26½	....	....
Buffalo, Niagara & East. Pwr. com. $1.20—no par	k 35½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	k 90	98	101
California Ry. & Pwr., 7% pf.	k135	....	....
Carolina Pwr. & Lt., pf.—$7—no par	f110½	109	110½
Central & S. W. Util., $7 pf.—no par	a102	99½	105½
Central & S. W. Util., pr. in. $7 pf.—no par	a103½	103½	108
Central Ark. Ry. & Lt., 7% pf.	104	105	107
Central Ill. Pub. Serv., $6 pf.	a 98½	97½	99½
Central Ind. Pwr., 7% pf.	a 97½	95	99½
Central Maine Power, 6% pf.	95	....	....
Central Maine Power, 7%	107	109	112
Central Pwr. & Lt., 7% pf.	104½	104½	105½
Central States Elec., 7% pf.	106	104	107
Century Elec., 6% com.	m145	140	145
Chicago Fuse Mfg., com.—$2.50 no par	a 30	30	33½
Cincinnati Gas & Elec., 5% com.	g 98½	97½	100
Cities Service, $6 pf.—no par	l 96½	94½	96½
Cities Service, pf. B—no par	k 8½	8½	9½
Cities Service, pf. BB—no par	k 90½	88½	90½
Cities Service, com.—20	l 56½	54	56½
Cities Service, Bks. Shrs.—10	m 27½	22½	27
Cities Service Pwr. & Lt., 7% pf.	k106½	107	109½
Cities Service Pwr. & Lt., 6% pf.	k 95½	95	96½
Cleveland Elec. Illg., 6% pf.	114	113	115
Cleveland Elec. Illg., 10% com.	360	350	370
Columbia Gas & Elec., 6% pf.	107½	107½	110½
Columbia G. & E. com. $5—no par	91½	89½	97½
Columbus Elec. & Pwr., $2 com.—no par	m 70	66	71
Columbus Elec. & Pwr., 7% pf.	113	....	....
Columbus Ry., Pwr. &Lt., 7% pf.	106½	....	....
Columbus Ry., Pwr. & Lt., 7 %pf. B	105½	....	....
Columbus Ry., P.& Lt. com.—no par	105	....	....
Commonwealth Edison, 8% com.	a174	165	189
Commonwealth Pwr., 6% pf.	102½	102½	104½
Commonw'th Pwr., $2, com.—no par	66½	62½	69
Conn. Lt. & Pwr., 8% pf.	119	120	123
Conn. Lt. & Pwr., 7% pf.	116	118	121
Cons. Gas of N. Y., pf.	101½	101½	102½
Cons. Gas of N. Y., com. $5—no par.	130½	119½	139½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e112½	110½	113
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e110½	110½	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e110½	110½	115
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e125½	125½	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par.	e 70	67½	72½
Consolidated Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	104½	105½	106½
Consumers Pwr., 6.6% pf.	106½	106	107
Continental Gas & Elec., 7% pr. pf.	106½	106½	108½
Conti. G. & E. com. $4.40—no par.	k235	240	265
Crocker Wheeler, com.†	30	23	38
Crocker Wheeler, 7% pf.	90	78	91
DALLAS PWR. & LT., 7% pf.	110½	110	111½
Dayton Pwr. & Lt., 6% pf.	108½	108½	109½
Detroit Edison, 8% com.	178½	166½	194½
Dubilier Condenser, com.—no par.	3½	2½	3½
Duke Pwr., cap.	k135	130½	145
Duquesne Lt., 7% pf.	116½	115½	116½
EASTERN NEW YORK UTIL., $7 pf.	k110½	111	112½
Eastern New York Util. com.	k 55	....	....
Eastern States Pwr. $7, com.	k 12	12	14½
Eastern States Pwr., pf.	k 97	98	99
East. Tex. Elec., 7% pf.	108	106	109
Edison Elec. of Boston, $12 com.	d256	252	268
El Paso Elec. 7% pf.	113	110	112½
Elec. Bond & Share, 6% pf.	d109½	109½	111½
Elec. Bd. & Sh. Sec., com. $1—no par	l 87½	76	94½
Electric Household Util.†	a 14½	13½	15½
Elec. Investors, 6% pf.—no par.	102	101	102½
Elec. Investors, com.†—no par.	41½	40½	45½
Elec. Pwr. & Lt., ctfs. pf.	109½	106½	109½
Elec. Pwr. & Lt., ctfs., 40% pd.	k122½	120½	123
Elec. Pwr. & Lt., ctfs., com.—no par	33½	28½	34½
Elec. Refrig. cap.†	14½	11½	15½
Elec. Ry. Securities, com.—no par.	6½	6½	7
Elec. St. Battery com. $5.25—no par	71½	69	75½
Elmira Wtr., Lt. & R.R., 7% pf.	k105	104	105½
Empire Pwr., pfc.†	30½	27½	35½
Engr. Pub. Serv. $7. pf.—no par.	k108½	107	109
Engr. Pub. Serv., com.—no par	34½	33	36½
Eureka Vacuum Cleaner, com. $4—no par.	71½	69	79
FAIRBANKS MORSE, 7% pf.	k106	104	106½
F.-M., com.—$3—no par.	37½	32½	40½
Federal Lt. & Trac., com. $1.40	51½	42	55
Federal Lt. & Trac., $6 pf.—no par.	101	98	105
Florida Pwr. & Lt., 7% pf.	107	105	107½
Ft. Worth Pwr. & Lt., 7% pf.	d113½	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	77	75	78
Galveston-Houston Elec., com.	32	31	34
General Cable, Cl.A	a 62½	56	64
Gen. Elec. $3 com.—no par.	126½	124	138½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.) com A $1.50—no par.	40½	35½	40½
Gen. G. & E. (Del.) pf. A, $8—no par	k123	122½	126½
Gen. G. & E. (Del.) pf. A $7—no par.	k112½	112½	112½
Gen. G. & E. (Del.) pf. B $7.	107	105½	107
Gen. Pub. Serv., $7 cum. pf., no par.	k119½	115	120
Gen. Pub. Serv., com., no par.	19	16½	20½
General Public Utilities, $7 pf.	98½	98	99
Ga. Lt., Pwr. & Rys., com.	k 58	55	65
Ga. Ry. & Pwr., 8% pf.	k125	....	....
Ga. Ry. & Pwr., 7% pf.	k113½	....	....
Gt. Western Pwr., 7% pf.	k105	....	....
IDAHO PWR., 7% pf.	108½	109	110
Ill. No. Utilities, 6% pf.	k 96	96	98
Ill. Pwr. & Lt., 7% pf.	104	103	105
Ingersoll Rand com.	k 90	90	94
Int. Combus. Engr., com. $2—no par	47½	45½	55½
Int. Combustion Engr., 7% pf.	k103½	103½	105½
Int. Util., Class A—$3.50—no par.	k 45½	45	51½
Int. Utilities, Class B—no par.	k 7½	3½	10½
Interstate Pwr., pf.—$7—no par.	101	99	101
Interstate Pub. Serv., 7% pf.	104	103	104½
Iowa Ry. & Lt., 7% pf.	k100	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	107½	105	107
Johns-Manville, com.†—no par.	116½	114	125
Johns-Manville, 7% pf.	m119½	119½	120

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; f Montreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Feb. 25. lBid price Wednesday, Feb. 29. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Feb. 28	Low 1928	High 1928
KANSAS CITY PWR. & LT. pf. $7	k116	115	116
Kansas Gas & Elec., 7% pf.	l109½	107	109
Kentucky Hydro-Elec., 7% pf.	k103	100	104
Kentucky Sec., 6% pf.	92	94	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	k101	100	102
LACLEDE GAS LT., 10% com.	k200	200	260
Lehigh Pwr. Sec., com.—no par	25	19½	27½
Long Island Ltg., 7% pf.	112	110½	112½
Long Island Ltg., com.†—no par	k170	170	180
Los Angeles Gas & Elec., 6% pf.	108	105	109
Louisville Gas & Elec., cl. A. $1.75	28½	28	29½
MAN. ELEC. SUPPLY, cap. $5—no par	53	50	54½
Manilla Elec., com.†—no par	k 45	45½	50
Maytag Mfg.,com.50—no par,	31	30½	34½
Memphis P. & L., pf.—$7—no par	k109½	109	111
Metropolitan Ed., pf.—$6—no par	106½	103	107½
Metropolitan Ed., pf.—$7—no par	109	109	111
Metropolitan Ed., com. $5—no par	k140	....	....
Middle West Utilities, 7% pf.	a123½	116½	124½
Middle West Util., 7% pr. lien	a128	125½	129½
Middle West Util., com. $6—no par	a132	123½	135
Midland Utilities, pr. ln. 6% pf.	a 95½	94½	96½
Midland Utilities, 7% pf. A	a103	103	104
Milwaukee Elec. Ry. & Lt., 7% pf.	k103	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 99	98	101½
Minn. Pwr. & Lt., 7% pf.	l109	107	109
Miss. River Pwr., 6% pf.	108	94	108
Miss. River Pwr., 3% com.	m 62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	k107	100	109
Mohawk Hudson Pwr., 2d pf.—$7—no par	k104	100	109
Mohawk Hudson Pwr., com.—no par	29½	29½	31½
Montana Pwr., 5% com.	164½	102½	167
Montreal Pwr., 7% com.	f 90½	....	....
Mountain States Pwr., 7% pf.	k103	97	103
Mountain States Pwr., com.†	16½	....	....
NASSAU & SUFFOLK LTG., 7% pf.	109	98	110
National Carbon, 8% pf.	a138½	138	139
National Elec. Pwr., A†	a 31½	27½	32½
National Lt., Ht. & Pwr., com.	k 24	20	30
National, Light, Ht. & Pwr., 5% pf.	k 72	70	80
National Pwr. & Lt., pf.—$7—no par	109½	108½	111
National Pwr. & Lt., com.†—no par.	25½	21½	27½
National Pub. Serv., 7% pf.	102	99	103
National Pub. Serv., 7% ptc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par	25½	22	27½
National Pub. Serv., B com.—no par	27½	24½	30
Nebraska Pwr., 7% pf.	l110	110	111½
Nevada-Calif. Elec., com.	k 35	22	37
New Brunswick Pwr., 4% pf.	k 60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	k110	98½	104
New Eng. Pub. Serv., pf. $7	108	95	100
New Orleans Pub. Serv.—7% pf.	108½	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	100	91	100
N. Y. Central Elec., 7% pf.	k103	101	104
New York Power & Light 7% pf.	k114½	....	....
New York Power & Light, 8% pf.	114	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	110	115
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	110	115
Niagara Falls Pwr., 7% pf.—25.	28½	28	28½
No. Amer., 6% pf.—50.	54½	53½	55
No. Amer., com.—10.	61½	58½	62½
No. Amer. Edison, $6 pf.—no par.	103	102½	105½
No. Caro. Pub. Serv., pf.—$7—no par	109	93	105
Northeastern Pwr., com.	20½	19½	23
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	24½	18	24½
No. Ont. Lt. & Pwr., 6% pf.	k 98	94	99
No. Ont. Lt. & Pwr., 4% com.	k 72	73	78
No. States Pwr. (Del.), 7% pf.	k108½	101	110
No. States Pwr. (Del.), 8% com.	131½	123	136½
No. Texas Elec., 6% pf.	58	45	70
No. Texas Elec., com.	18	5	36
OHIO BRASS, com. B $4—no par.	k97½	89	98½
Ohio Brass, 6% pf.	k107	100	111
Ohio Pwr., 6% pf.	106½	104	107½
Ohio Pub. Serv., $6 pf.	k102½	95	102
Ohio Pub. Serv., 7% pf.	111	107	111
Ohio River Edison, 7% pf.	109	106	109½
Oklahoma Gas & Elec., 7% pf.	112	....	....
PACIFIC Gas & ELEC., 6% pf.	27½	26½	28½
Pacific Gas & Elec., 8% new com.	44½	43½	49½
Pacific Pwr. & Lt., 7% pf.	l109	106	108½
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 79½	77½	79½
Penn-Ohio Edison, 6% pf. no par	94	93½	96
Penn-Ohio Edison, 7% pf.	106½	106½	109
Penn-Ohio Pwr. & Lt., 7% pf.	109½	99	110
Penn Pwr. & Lt.—$7—no par.	l110½	109½	110½
Penn Wtr. & Pwr., $2.50 com., new	c 70	68	72½
Phila. Co., 5% pf.—50.	k 45½	46½	48½
Phila. Co., 6% pf.—50.	53½	52	53
Phila. Co., com.—50.	k148	149½	163
Phila. Elec., 8% com.—25.	c 57	55½	59
Portland Elec. Pwr., 7% pf.	103½	100	104½
Portland Elec. Pwr., 6% pf.	94	78	84
Portland Elec. Pwr., 6% 2d pf.	85	55	70
Portland Elec. Pwr., com.	48	22	30
Potomac Elec. Power, 6% pf.	l110½	....	....
Pwr. Sec., pf.—no par.	k 58	50	60
Pwr. Sec., com.—no par.	k 12	5	15
Public Serv. of Colorado, 7% pf.,	l108	....	....
Pub. Serv. of N. J., 6% pf.	106½	103½	106½
Pub. Serv. of N. J., 7% pf.	119½	118	120½
Pub. Serv. of N. J., $2 com.—no par	43	41½	45
Pub. Serv. of No. Ill., 6% pf.	a110	110	113½
Pub. Serv. of No. Ill., 7% pf.	a119	119	121
P. S. of No. Ill., com. $8—no par.	a170½	159½	180
Pub. Serv. of No. Ill., $8 com.	k165	130½	160
Pub. Serv. of Okla., 7% pr. ln.	k105	100	107
Pub. Serv. Elec. & Gas, 6% pf.	109½	109	110½
Puget Sound Pwr. & Lt., 7% pf.	k110	105	109
Puget Sound Pwr. & Lt., $6 pf.—no par	98	92	98½
Puget Sound Pwr. & Lt., com.	48	34½	50
RADIO COPR. OF AMER., $3.50 pf.—50.	k 93½	85½	104½
Radio Corp. of Amer., com.—no par.	93½	85½	104½
Rhode Island Public Service, pf. $2 —no par.	k 31½	30½	31½
Rochester Gas & Elec. 6% pf. D.	105	105½	106½
Rochester Gas & Elec., 7% pf. B.	107	105	107
Rochester Gas & Elec., 7% pf. C.	105	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	k114	110	115½
St. Joseph Ry., L., H. & P., 5% pf.	k 75	70	75
Servel, Inc.	6½	4½	7½
Sierra Pacific Elec., 2% com.	35½	29	38½
Sioux City Gas & Elec., 7% pf.	107	....	....
Southeastern Pwr. & Lt., pf.—$7 no par.	l 108½	....	....
Southeastern Pwr. & Lt., ptc. pf.	l 68	....	....
Southeastern Pwr. & Lt., com.—no par.	42	41½	44½
So. Calif. Edison, 8% pf.	k 45½	38½	41
So. Calif. Edison, 7% pf.	k 29	27	29½
So. Calif. Edison, 6% pf.	k 26½	25½	28
So. Calif. Edison, 8% com.	45½	43½	47½
Southern Cities Utilities, 7% pf.	k 76	75	77
Southwestern Lt. & Pwr., A $3.	70	....	....
Southwestern Lt. & Pwr., B.	65	....	....
Southwestern Lt. & Pwr., $6 pf.	91½	....	....
Southwestern Pwr. & Lt., 7% pf.	k111½	103	113
Standard Gas & Elec., 8% pf.	68	65	68
Standard Gas & Elec., 7% pr. pf.	111½	108	113
Standard G. & E., com. $3.50	61½	57½	65
Standard Power & Light, com.	4½	29½	42
Standard Pwr. & Lt., 7% pf.	k105	98	105
Staten Island Edison, pf.—$6—no par	102½	99	103½
Superheater, $6 com.—no par	170	....	....
Syracuse Lighting, 7% pf.	k110	103	111
Syracuse Lighting, 8% pf.	k117½	114	119
TAMPA ELEC., com. $2.	62	62	64
Tenn. Elec. Pwr., 6% pf.	103½	92	103
Tenn. Elec. Pwr., 7% pf.	l09½	107	110
Terre Haute, Ind. & East. Trac., 5% pf.	k 10	....	....
Terre Haute, Ind. & East. Trac., com.	k 1	1	3
Tex. Pwr. & Lt., 7% pf.	l113½	113½	115
Tide Water Pwr., 8% pf.	111	....	....
Timken Roller Bear., com.—$4 no par.	118	113½	134
Toledo Edison, 7% pf.	l109	....	....
Toledo Edison, 6% pf.	k103	95	105
Toledo Edison, 6% com.	k100	93	102
Tri-City Ry. & Lt., 6% pf.	k100	96	99
UNITED GAS & ELEC., 6% pf.	99	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50.	c114½	111½	117½
United Lt. & Pwr., pf.—$4—no par.	a 55½	53	55½
United Lt. & Pwr., pf.—$6.50—no par.	a 99½	....	....
United L. & P., com. A .48—no par	a 17½	....	....
United L. & P., com. B .48—no par.	m 18	....	....
Utah Pwr. & Lt., 7% pf.	l 113	109½	112½
Utica Gas & Elec., 7% pf.	105	....	....
Utica Gas & Elec., 8% com.	k200	215	225
Utilities Pwr. & Lt., 7% pf.	100½	98	101½
Utilities Pwr. & Lt., com. A $2.	31	28½	31½
Utilities Pwr. & Lt., com. B $1—no par.	24½	18½	24½
VERMONT HYDRO-ELEC., 7% pf.	k100	95	100
Virginia Elec. & Pwr., 7% pf.	k111	108	111
WAGNER ELEC., 7% pf.	b 99	96½	99
Wagner Elec., com.—no par.	b 40½	37	40½
Washington Ry. & Elec., 5% com.	j485	....	....
Washington Ry. & Elec., 7% pf.	j103½	....	....
Washington Wtr. Pwr., 8% com.	k225	....	....
West Penn Elec., 7% pf.	113½	109½	114½
West Penn Elec., Cl. A $7.	k109	....	....
West Penn Pwr., 7% pf.	115½	114½	116½
West Penn Pwr., 6% pf.	109½	109½	113
West Virginia Lt., Ht. & Pwr., 7% pf.	k 95	94	100
Western Pwr., 7% pf.	k102	98	105
Western States Gas & Elec., 7% pf.	104	101	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	92	88½	100½
Weston Elec. Instrument, Cl. A $2 —no par.	k 32	30½	30½
Weston Elec. Instrument, com.—no par.	k 12½	12½	14½
Wheeling Elec., 6% pf.	k104	95	104
Worthington Pump, 7% pf. A.	k 49½	46½	55
Worthington Pump, 6% B.	k 43	41	49½
Worthington Pump, com.	k28	28	34½
YALE & TOWNE com. $5—25.	k 73	72½	75

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Feb. 25. *l*Bid price Wednesday, Feb. 29. *m*Latest quotations available. †Dividend rate variable.

in competition with you must be required to buy out your plant. You cannot have your cake and eat it at the same time. And if you are going to take that attitude with the Commonwealth, the people may well say, While we have granted you the sovereign power of eminent domain, we are not justified in doing that unless you are performing a state service or a governmental function, and if you take the attitude that you are a private corporation that is not performing any state or governmental function, you cannot complain if you are not authorized to exercise the sovereign power of eminent domain.

Public Protection Needed

We have no pride in phraseology, but we do say that we ought to have some such legislation or the people of Massachusetts will realize that they have no protection against extortionate charges and corporate greed in the operation of the public utilities; that all they can do is to rely upon the kindness, charity and generosity of these gentlemen who run public utilities in the Commonwealth.

In the first place, it seems to me that we here in Massachusetts are not asking for charity, we are not asking for generosity. We ought not to put ourselves under obligation to these gentlemen who want to make 40, 50 and possibly 60 per cent upon their original investment.

Think of it! Here is a company located in this Commonwealth, amply able to approach and meet the rate which is now charged by the municipal plant in Holyoke, taking the attitude that it ought to receive for its stock in the market, if it sells it, nine times its par value, which means, in order to make the stock worth that amount on a basis of 6 per cent, that it has got to charge the public rates which will produce 54 per cent upon the par value of the stock each and every year. When it does that, do you think the public is going to stand for it? Do you think the public is going to sit idly by, and not go into the business itself, rather than have that sort of situation existing, that sort of burden imposed upon the people of the Commonwealth?

Radio Corporation Shows Record Net Earnings

Gross income from operations of the Radio Corporation for 1927 has reached the high record of $65,082,074 and net income transferred to surplus, is $8,478,320, against $4,661,397 in 1926. Surplus account shows a write-off of $1,000,000 in the patent account, a reserve of $4,500,000 for plant and equipment and a writing down of $799,310 in sundry, machinery, tools and furniture. Dividends were $1,368,150, leaving surplus at the close of 1927 at $7,029,621, against $6,218,761 a year previous.

Income account shows the deduction of reserves amounting to $3,321,330, against $2,735,090 in 1926. Of 1927 reserves, $2,371,330 has been set aside for federal income taxes and amortization of patents, and $950,000 as a general fund reserve and as reserve against foreign investments, etc.

Engineers Public Service Earnings Up 12.5 Per Cent

The high lights of the financial statement of the Engineers Public Service system are a 10.7 per cent increase in gross earnings and an expansion of only 9.6 per cent in operating costs, making possible a growth of net earnings amounting to 12.5 per cent. The balance for reserves and for Engineers common stock, after deducting dividend requirements for Engineers preferred stock, increased 26.7 per cent over 1926. The average net return shown by the properties for the year was slightly less than 6 per cent of the net book value.

Operating statistics of the company readily explain the gratifying progress noted above as reflected in the earnings statement. The electrical output of the system is up 17.1 per cent to 746,521,859 kw.-hr. The light and power departments serve a population of 1,314,200, and these departments account for 60.4 per cent gross earnings. The operating ratio in the light and power departments is 46.8, which is considerably better than the average for systems of this type.

Interest, amortization, etc., for the entire system were earned well over three times during the past year, as has been the case since the company's inception. The balance after interest, etc., was $7,921,822, or 26.9 per cent of gross. Balance after subsidiary preferred dividends was $6,312,274. Parent company preferred stock required $2,173,276, leaving $4,034,702 applicable to reserves and to common stock dividends. There are 310,468 shares of no-par $7 preferred outstanding in the hands of the public and of the no-par common about 797,240 shares are outstanding and 200,000 reserved for issue under option warrants. The preferred is currently quoted around 10[illegible] and the common around 34.

HOUSTON LIGHTING FINANCES POWER PLANT ENLARGEMENT.—An amendment to the charter of the Houston Lighting & Power Company, Houston, Tex., increasing its capital stock from $7,000,000 to $9,000,000 has been filed in the Secretary of State's office. The proceeds from the additional stock will be used for enlarging the company's power plant at Deepwater.

Substantial Volume of New Offerings in February

THOUGH new financing by the electric light and power companies of the country shows signs of easing off this year, the substantial sum of $103,255,500—February's total—is evidence that the electrical utilities will continue to play an important part in the securities market. The figure recorded for February compares with $98,850,000 for January and with $166,000,000 for February, 1927. New securities brought out during the two-month period total $202,105,500, as compared with $389,859,000 during the corresponding period of the preceding year. The Pacific Gas & Electric Company contributed $20,000,000 to the total, as did also the National Public Service Corporation, these being the largest individual issue floated during the month.

Attention is called to the prominent part taken by refunding operations. The public utilities are taking advantage of low money rates by retiring their securities bearing high interest rates in favor of lower interest bearing securities. An interesting feature of the month's financing was the issuance by the Public Service Corporation of New Jersey of 4½ per cent convertible debentures to the amount of $43,689,000 to holders of its common and 8 per cent preferred stock. The average rate of return yielded the investor on the February offerings declined to the 5.20 per cent mark from 5.40 in January.

Security Issues of Electric Service Companies in February

Name of Company	Amount of Issue (Par Value)	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Pennsylvania Water & Power Co.	$6,000,000	40	First refunding mortgage gold bonds, series B	To retire bonds	4¼	99	4.55
Pacific Gas & Electric Co.	20,000,000	29	First and refunding mortgage gold bonds, series E	To retire funded debt of subsidiaries recently acquired	4¼	99	4.56
Indiana Service Corp.	5,000,000	35	First lien and refunding mortgage gold bonds, series A	To reimburse for capital expenditures and for additions and improvements	5	99½	5.03
National Gas & Electric Corp.	3,400,000	25	First mortgage collateral gold bonds	To provide funds for purchase of securities of subsidiaries or for other capital requirements	5½	98½	5.60
	1,800,000	3	Convertible gold notes		5½	100	5.50
Ohio Power Co.	10,018,000	29	First and refunding mortgage gold bonds	To retire outstanding bonds	4½	96	4.75
Alabama Power Co.	1,950,000	..	Cumulative preferred stock	To raise funds for construction and additions, and to reimburse for expenditures made on improvements	5	97½	5.12
National Public Service Corp.	20,000,000	50	Secured gold debentures	To retire bonds and for other corporate purposes	5	93¾	5.35
New England Public Service Co.	2,412,500	..	Preferred stock	To refund short-term loans outstanding and for other corporate purposes	6	96½	6.20
American Superpower Corp.	9,225,000	..	First preferred stock	To raise funds for the acquisition of additional interests in certain light and power companies and for other corporate purposes	6	102½	5.85
Western Power, Light & Telephone Co.	2,750,000	20	First lien collateral gold bonds, series A	To retire notes, acquire new subsidiaries, to provide additional working capital and for other corporate purposes	6	100	6.00
Central Arkansas Public Service Corp.	2,700,000	20	First lien and collateral trust gold bonds, series A	To redeem bonds, for additions and extensions and for other corporate purposes	5	94½	5.45
Northwestern Public Utilities, Inc.	350,000	1	Gold notes, series A	To acquire properties, to reimburse for capital expenditures and for other corporate purposes	5	99	6.04
Birmingham Electric Co.	9,200,000	40	First and refunding mortgage gold bonds	To retire bonds and for other corporate purposes	4½	95½	4.77
National Electric Power Co.	2,500,000	..	Cumulative preferred stock	To acquire additional securities of subsidiary companies	6	94½	6.35
New England Water, Light & Power Associates	1,450,000	20	Collateral lien gold bonds, series A		5½	100	5.50
Oklahoma Power & Water Co.	4,500,000	20	First mortgage gold bonds, series A		5	96½	5.30
Total	$103,255,500			Rights		$43,689,000	
Total amount actually realized	100,432,217			Total financing for February		144,121,217	

Business News and Market Conditions

Base Wire Price Indicates Small Differential

Present Price Lower Than That Quoted at Beginning of 1927 — Margin in Carload Lots About 1½ Cents

DESPITE the complaint of wire manufacturers that prices are very close owing to keen competition, the year 1927 closed with a base copper wire price lower than that quoted at the beginning of the year. The base price is only 1¾ cents higher than the market price of electrolytic copper and is that figure today. The published base prices for the year 1927 are given in the accompanying table. The figures shown are the same as those printed in the ELECTRICAL WORLD each week in connection with the non-ferrous metal market prices and survey.

PUBLISHED BASE WIRE PRICES

Date	Copper	Differential	Finished Base
1927			
Jan. 4	13½	$2.00	15½
Jan. 13	13⅝	2.00	15⅝
Jan. 28	13½	2.00	15½
Feb. 1	13	2.00	15
Feb. 7	12⅝	2.00	14⅝
Feb. 8	12⅝	2.125	14¾
Feb. 11	12⅝	2.00	14⅝
Feb. 21	13⅛	2.00	15⅛
Feb. 28	13⅝	2.00	15⅝
April 7	13	2.00	15
April 20	13⅛	2.00	15⅛
May 24	12⅝	2.00	14⅝
June 22	12⅛	2.00	14⅛
July 18	12⅝	2.00	14⅝
July 25	13	2.00	15
Aug. 2	13½	2.00	15½
Nov. 9	13½	1.75	15¼
Nov. 19	13⅝	1.75	15⅜
Dec. 1	13⅞	1.75	15⅝
Dec. 2	14	1.75	15⅞
Dec. 7	14⅛	1.75	15⅞

NOTE.—Base wire prices are listed only when a change in the price of copper takes place.

In carload lots the differential is about ¼ cent less, making a present differential of only about 1½ cents over the actual selling price of electrolytic copper delivered.

In discussing the situation and to emphasize that wire business is being done on an extremely close and unprofitable margin, manufacturers estimate that the gross business of the whole wire industry is between $150,000,000 and $200,000,000 and the capital investment is over $100,000,000. The return on the capital investment is estimated as probably not more than 5 per cent. In addition to the poor return, it is pointed out that the manufacturer carries a very high business risk when one considers the violent fluctuations in the copper market over the last ten years and the possibility of similar fluctuations at any time.

Value and Destination of Electrical Exports for December, 1927, Compared With Corresponding Month in 1926

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	December 1926	December 1927
Generators:		
Direct-current:		
Under 500 kw.	$83,270	$76,946
500 kw. and over	12,150	86,026
Alternating-current:		
Under 2,000 kva.	3,313	8,646
2,000 kva. and over	198,629	77,918
Steam turbine generator sets	38,699	115,996
Accessories and parts for generators	97,428	963,738
Self-contained lighting outfits	115,563	162,272
Batteries:		
Flashlight batteries	181,504	255,686
Other primary batteries	195,034	218,047
Storage batteries	343,773	324,208
Transforming or converting apparatus:		
Power transformers	195,143	137,364
Other transformers	115,685	78,924
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	140,420	245,881
Transmission and distribution apparatus:		
Switchboard panels, except telephone	103,597	192,462
Switches and circuit breakers over 10 amp.	262,467	147,354
Fuses and fuse blocks	24,056	29,943
Watt-hour and other measuring meters	35,614	48,576
Volt, watt, and ampere meters and other recording, indicating, and testing apparatus	202,570	213,064
Lightning arresters, choke coils, reactors, and other protective devices	57,644	55,212
Motors, starters, and controllers:		
Stationary motors:		
Motors under 1 hp.	186,205	225,478
1 to 200 hp.	216,820	186,889
Over 200 hp.	30,134	11,552
Railway motors	$56,244	$115,777
Electric locomotives:		
Railway	72,562	35,042
Mining and industrial	29,817	127,610
Starting and controlling equipment for:		
Industrial motors	83,406	115,783
Electric railway and vehicle motors	5,872	21,189
Portable electric tools	66,175	82,406
Accessories and parts for motors	154,096	209,299
Electric appliances:		
Electric fans	56,876	44,074
Electric lamps:		
Metal filament	137,918	124,587
Other electric lamps	28,707	50,934
Flashlights	166,361	236,460
Searchlights and projectors	121,228	173,739
Motor-driven household devices	214,933	156,780
Domestic heating and cooking devices	172,788	150,616
Industrial electric furnaces and ovens	23,391	37,794
Therapeutic apparatus, X-Ray machines, galvanic and faradic batteries, etc.	123,120	148,683
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	8,005	93,131
Receiving sets	361,132	314,888
Tubes	67,702	106,354
Receiving set components	264,901	242,529
Receiving set accessories	269,449	277,862
Telegraph apparatus	75,144	162,274
Telephone apparatus:		
Telephone instruments	19,048	29,681
Telephone switchboards	25,204	3,259
Other telephone equipment	200,367	224,179
Railway signals, switches and attachments	$29,358	$61,190
Bells, buzzers, annunciators, and alarms	27,285	21,137
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	114,114	158,956
Insulating material	106,188	98,082
Metal conduit, outlet and switch boxes	97,298	98,241
Sockets, receptacles, and lighting switches	152,859	157,808
Electric lighting fixtures, interior and street	155,064	167,063
Other wiring supplies and line material	85,149	75,855
Other electrical apparatus, not elsewhere stated	666,417	665,049
Rubber and friction tape	27,931	29,393
Globes and shades for lighting fixtures	60,558	49,802
Electrical glassware except for lighting	36,518	14,702
Electrical porcelain:		
For less than 6,600 volts	48,499	71,819
For 6,600 volts and over	52,576	49,047
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	151,066	243,444
Other carbon products	153,216	55,399
Insulated wire and cable (iron and steel)	42,439	9,294
Copper, bare wire	112,956	137,044
Copper, insulated wire and cable	350,274	390,287
Refrigeration sets up to 1 ton capacity	*	369,937
Domestic washing machines	138,127	107,193
Total	$8,272,864	$10,178,854

*Not collected in 1926.

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	December, 1927
EUROPE:	$1,682,952
Belgium	73,931
France	129,103
Germany	129,507
Italy	106,340
Netherlands	96,866
Spain	144,011
United Kingdom	577,183
Other countries	426,011
WESTERN HEMISPHERE:	$5,769,295
Canada	1,971,553
Mexico	522,926
Cuba	353,932
Argentina	1,411,180
Brazil	381,858
Chile	268,539
Colombia	166,951
Peru	71,436
Venezuela	117,261
Other countries	503,659
ASIA, AFRICA AND OCEANIA:	$2,726,607
British India	285,758
China	119,625
Japan	722,039
Philippine Islands	196,701
Australia	530,333
New Zealand	251,102
British South Africa	225,245
Other countries	395,806

Table of Preferred Numbers Issued by A.E.S.C.

The American Engineering Standards Committee has just published and informally approved a table of preferred numbers which is being recommended to American industry for trial and criticism. This system of preferred numbers with the approval of industry may at a later date be considered for adoption as an American standard. The committee, in discussing the system of preferred numbers, states that its purpose is to eliminate the economic loss involved in the haphazard and often needlessly numerous gradations of size that characterize most of our common commodities. The fundamental elements of the system lie in the proposal to arrange standard size series so that each succeeding model in a series shall be larger than the preceding size, not by a definite amount, but by a fixed percentage. By decreasing the number of sizes within a certain range, while retaining a sufficient number of sizes in all parts of the range, a system of preferred numbers makes it possible to effect savings in materials, labor, storage space, gages, containers, catalogs, sales cost, etc. As an example of the working of preferred numbers, it is pointed out that a difference of $\frac{1}{4}$ in. in width would be important in a brush $\frac{1}{2}$ in. wide, while in a brush 5 in. wide a difference of $\frac{1}{4}$ in. would be hardly discernible. Instead of having quarter inch increases throughout the whole range of sizes, therefore, sizes can be increased by a fixed percentage without eliminating any which are necessary and decreasing the total number. It is further added that preferred numbers have been used with success in many European countries, including France and Germany, and their adoption in this country is considered by many engineers to be one of the most important steps in the industrial standardization movement.

Market Conditions

VIRTUALLY throughout the country activities in the industry are reported at a good level, with some interesting orders placed. In the New England district increasing strength is noted. Small motor sales gained and shipments of pole line hardware, cross-arms and wire to northern New England are recorded in good volume. Industrial electric heating also is active. Large substation equipment orders amounting to nearly $500,000 were placed in the New York district and current inquiries point to a heavy volume of buying at an early date. A Long Island company bought $100,000 worth of switching equipment and a central-station company in northern New York ordered generating equipment amounting to $130,000.

Trade is quiet in the Southeast, but a good deal of industrial business is in prospect. An Alabama steel mill purchased $70,000 worth of motors and control equipment. A new city ordinance in Atlanta has stimulated sign business, and three municipalities purchased $12,000 worth of motors and pumps for water works. Industrial equipment sales are active in the St. Louis district. A manufacturer ordered $25,000 worth of motors and an oil company bought $100,000 worth of apparatus. An order for $175,000 worth of substation equipment also was placed in St. Louis. Sales of small industrial equipment are above normal. Utilities continue active buyers in the Middle West and building construction is increasing. On the Pacific Coast an active week has been reported, many pole orders were placed, and oil field buying was very good. Motor sales in Seattle exceeded those of any one week since the first of the year.

Low Prices Stimulate Sales in Metal Market

At the expense of a decline in price the tonnage sold in the non-ferrous metal market was the best for a considerable period. Copper touched 13.875 cents on some sales on Tuesday, and on Monday 5.40 cents was done for zinc.

NEW YORK METAL MARKET PRICES

	Feb. 21, 1928 Cents per Pound	Feb. 29, 1928 Cents per Pound
Copper, electrolytic	14	13.95
Lead, Am. S. & R. price	6¼	6
Antimony	10¾	10¼
Nickel, ingot	35	35
Zinc spots	5.80	5.825
Tin, Straits	51.725	51⅛
Aluminum, 99 per cent.	24.30	24.30

Base copper price Feb. 29, 1928, 15¼ cents.

There has been some upward reaction in both metals since then. Lead is now 6 cents in New York and could probably be obtained in St. Louis at 5.75 cents. Tin has been up and down with little or no net change.

Industrial Prospects Bright in the Southeast

Trade in the Southeast is quiet, with central-station companies not yet buying in the volume to be expected for this period. There is a very satisfactory amount of industrial business in prospect. The largest order reported was placed by an Alabama steel mill for synchronous motors and control equipment amounting to $70,000, the same mill also ordering $25,000 worth of small motor equipment. A central-station company ordered distribution and small power transformers agrgegating $14,000 and creosoted pine poles totaling $4,200. Another central-station order was for house-type meters amounting to $2,200. Small sign installations are showing a healthy increase, particularly in Atlanta, where a city ordinance has been changed to permit of signs projecting over the sidewalks. One order covered $1,400 worth of sign equipment.

Orders from three municipalities for motors and pumps for municipal water works, amounting to $12,000, were reported by a manufacturer. "Whiteway" equipment continues in satisfactory demand and among the orders for this material was one for $4,400 worth of metal standards and parkway cable for a Georgia town and two orders from Louisiana towns for equipment totaling $3,000. Merchandising activities of central-station companies continue brisk, one of the larger companies having recently sold 1,975 waffle irons in an eight-day sales campaign.

Construction projects are as follows: The Strowd-Holcombe Cotton Mills, Inc., Birmingham, Ala., plans an addition to cost $100,000. Henderson, Ky., plans extensions in its light and power plant to cost $50,000. The Henry Vogt Machine Company, Louisville, Ky., plans an addition to cost $100,000. Louise, Miss., plans a transmission line from Yazoo City, and the installation of a light and power system. Marshall, N. C., plans a hydro-electric power plant on the French Broad River to cost $100,000. The American Tobacco Company, Reidsville, N. C., plans an addition to its plant to cost about $750,000. The United States Corrugated Fibre Box Company, Wheeling, W. Va., plans a new plant unit to cost $125,000.

Market Gains Strength in New England District

Increasing strength in the electrical market is noted in the New England district. While no sales of outstanding interest were reported there was an encouraging activity in many lines. Small motor sales gained and one manufacturer reports that New England motor business is in advance in volume to date as compared with other districts, while another company records a steady demand for fractional-horsepower motors with the weekly volume comparable with that of last year. Shipments of pole-line hardware, cross-arms and wire to northern New England are recorded in good volume, and central-station buying is showing more vigor. Industrial electric heating is active. From southeastern Massachusetts and Rhode Island reports from manufacturers show much encouragement. The demand for special heating types is marked. Street lighting negotiations are numerous. A manufacturer of arc-welding equipment reports February orders advancing over those of January. Electric refrigerator sales are promising and one manufacturer plans for a 100 per cent increase in New England during the coming year.

New projects include an expansion of the Firestone Mills, New Bedford; a new mill will soon be erected for a Keene (N. H.) silk company; the American Electric Manufacturing company, Phillipsdale, R. I. plans the purchase of new equipment, and Middletown, Conn., plans a lighting system on Main Street.

Large Substation Equipment Buying in Eastern District

Substation business features equipment sales in the Eastern district and current inquiries point to a heavy volume of commitments at an early date. One company placed orders for nearly $500,000 worth of substation apparatus. Transformer business is trending upward and a leading manufacturer reports that the volume of sales for the first two months of this year exceeds those for the same period a year ago. While orders are relatively smaller, the broader extent of gross sales gives this showing. Out-door switching equipment is growing in demand. A Long Island company placed an order for about $100,000 worth of switching equipment. A utility operating in northern New York has been an active purchaser of switching apparatus, and also has purchased a 12,500-kva. waterwheel generating unit, with transformers and auxiliary apparatus aggregating $130,000. Orders from one company for motor-generator units for traction service amounted to $70,000. Transmission line business is quiet, although the early prospects appear better.

Industrial business continues at a good rate with motors and control apparatus especially active. Business in that line is advancing, with a call from iron and steel mills, textile mills, pulp and paper mills, and baking plants exceeding those of other basic industries. Baking plants have been prominent consumers in recent weeks. The Bethlehem Steel Company recently contracted with a leading manufacturer for control apparatus to cost about $42,000 for extensions in its limestone quarries at Naginey, Pa., to cost $200,000. A paper-manufacturing company at New York soon will place orders for control equipment for a proposed bag and paper mill at Tacoma, Wash., to cost more than $1,500,000. The Donner Steel Company, Buffalo, has placed an order for a 60-ton oil-electric locomotive, and the American Rolling Mill Company, Middletown, Ohio, has contracted for a unit of 100 tons capacity for service at its local mills. Minor demand and equally minor sales prevail in the electric railway equipment field, inquiries are scattered and business does not hold any promise for some weeks to come.

Construction projects comprise the following: The Signal Corps Procurement District, Governors Island, New York, is asking bids until March 13, for voltmeters, ammeters, etc. (Circular 123); for 38,300 ft. of conduit (Circular 125); for 32,100 ft. telephone cable (Circular 126). The Bayonne Steel Ceiling Company plans a plant at Long Island City to cost $100,000. The Bureau of Supplies and Accounts, Washington, D. C., is asking bids until March 6, for five motor-generator sets, with control panels and spare parts for the Brooklyn navy yard (Schedule 8525); also for spare parts for turbo-generators, (Schedule 8585). Spring Lake, N. J., plans municipal power plant. The Kensington Shipyard & Dry Dock Company, Philadelphia, Pa., plans extensions to cost $500,000. The National Lumber & Creosoting Company, Kansas City, Mo., plans a new plant at Wilmington, Del., to cost $1,000,000. The American Analine Products Company, Lock Haven, Pa., plans a new addition to cost $200,000. The United States Engineer, Pittsburgh, Pa., will soon take bids for a power house at Lock 6, Allegheny River, near Clinton, Pa. The Suburban Light & Power Company, Baltimore, Md., plans transmission lines and a distributing system in Calvert, Charles, St. Mary's and Prince George Counties to cost $750,000. The general purchasing officer, Panama Canal, Washington, D. C., will receive bids until March 10, for motors, transformers, switches and other electrical equipment (Schedule 1860). The chief of engineers, United States Army, Washington, D. C., is asking bids until March 27, for one 200-kw. Diesel engine-generating unit, switchboard and auxiliaries (Circular 15).

Utilities Continue Active Buyers in Middle West

Business in the Middle West is good. Here and there a slight slowing down is noticeable. Building activity is increasing, the railroads are contemplating large expenditures for equipment, and the steel industry is in good shape. The various utility companies are planning a good deal of construction work, and the Illinois Bell Telephone Company anticipates an expenditure for the year of $38,000,000. Considerable puchasing of apparatus is going on among which was an order for a number of oil circuit breakers, another for a total of nearly 27,000 kva. of transformers, and three 20-ton electric traveling cranes with appurtenances. Three construction orders, one for coal storage trackage construction valued at $95,000, duct and furnace insulation at $35,000 and pipe covering and insulation materials valued at $30,000 also were placed. Jobbers' sales are normal. Industrial activity is a trifle spotty but municipal and railroad business is good. Appliances are moving in fair volume.

Construction plans are as follows: The American Zinc, Lead & Smelting Company, East St. Louis, Ill., will make plant additions to cost $500,000. The University of Michigan, Ann Arbor, plans a power plant addition to cost $100,000. Detroit, Mich., plans an addition to its Springwells waterworks station to cost $4,000,000. The Michigan Public Service Company plans extensions at Ludington, Mich., to cost $75,000. Moose Lake, Minn., plans a municipal power plant. The Cudahy Packing Company, Newport, Minn., plans a five-story and basement cold storage and refrigerating plant, to cost $115,000. The Glancy Malleable Iron Corporation, Waukesha, Wis., plans an addition to its plant to cost $200,000 Mundelein, Ill., Carrington, N. D., and Neenah, and Kendall, Wis., plan an installation of street lighting equipment.

Active Week Reported on the Pacific Coast

An outstanding construction item reported on the Pacific Coast covers a 16-mile feeder line near Lisbon for the San Francisco-Sacramento electric line estimated to cost $700,000. Work on this line will begin in April. Many pole orders were placed. Oil field orders also were prominent. A steel company bought a switchboard for $2,500. A San Francisco power company bought a switchboard for $15,000. A lime company is in the market for $2,000 worth of wiring material and five assorted motors, a lumber company in the Sierra pine belt bought $3,000 worth of motors, and another lumber company needs $2,000 worth of wiring supplies. A San Francisco jobber bought a carload of electric ranges valued at $10,000. Snow conditions, while low, probably will not affect power supply but may help pumping plant sales.

The city of Seattle passed a bill appropriating $625,000 and authorizing extensions at the Gorge Creek hydro-electric plant on the Skagit River. Weatherproof copper wire amounting to $15,000 and 100 cedar poles also were purchased by the city. A contract for street lighting in Olympia was let for $17,000 and Oregon City, Ore., and Wenatchee, Wash., are planning additional street lighting installations. The Grays Harbor Railway & Light Company, Hoquiam, plans an expenditure of $60,000 for light and power transmission lines, and the Washington Water Power Company plans installing a second unit of 32,200 hp. at Chelan during this summer. Seattle jobbers report motor sales exceeded those of any one week since the first of the year.

Construction projects are as follows: The Arizona Wax Paper Company, Benson, Ariz., plans a plant at Salinas, Calif., to cost $100,000. A. M. Gilstrap, 3002 Logan Street, Oakland, Calif., plans a fruit-canning plant at Yuba City, to cost $450,000. The Pacific Gas & Electric Company, San Francisco, plans a hydro-electric development on the Mokolumme River, near Jackson; and a 50,000-hp. steam plant at Oakland. The Portland Electric Power Company plans a storage plant at Salem, Ore., to cost $50,000. The Airway Division, Department of Commerce, Salt Lake City, Utah, will receive bids until April 14, for 51-ft. steel towers, beacon lights, underground cable, etc., for the Beacon airport. The Western Cold Storage Company, Wenatchee, Wash., plans an ice plant to cost $500,000. The Union Pacific Railroad Company plans a rock-crushing plant near Grand Canyon,

Wyo., to cost $200,000. The San Joaquin Light & Power Corporation, Fresno, Calif., plans three 110,000-volt steel tower transmission lines, to connect with Rio Bravo, Corcoran and Taft substations, to cost $550,000.

The Great Northern Utilities Company plans a transmission line between Coutts and Sidney, Mont. The Utah Power & Light Company plans a transmission line from Echo to Evanston, Wyo., to cost $80,000. Stockton, Willows, Madera, Alameda and Berkeley, Calif., and Great Falls, Mont., plan ornamental lighting systems.

Industrial Equipment Sales Active in St. Louis

Conditions in the St. Louis district are holding to a normal level with signs of early spring business in good volume. A large manufacturing company changing from 25 to 60-cycle operation placed an order for motors aggregating $25,000. An oil company operating in the southwestern part of the district closed a contract for 44 400-hp. induction motors and 14 four-panel switchboards for driving pipe line pumps at a total cost of over $100,000. A large local power company closed contracts for transformers, circuit breakers, control and regulating apparatus for a large substation at a total cost of $175,000. Sales of small industrial equipment throughout the district are above normal.

Construction projects are as follows: The Arkansas Power & Light Company will build a transmission line from Gurdon to Delight, Ark., to cost $75,000. The Eastern Arkansas Compress Company, Forrest City, Ark., plans a new plant to cost $100,000. Trenton, Mo., plans a municipal power plant to cost $50,000. The Oklahoma Gas & Electric Company plans substations at Lexington, Meeker, Healdton and Wynnewood to cost $100,000. The Southern Ice & Utilities Company plans an ice plant at Big Spring, Tex., to cost $100,000. The Southwest Textile Mills, Inc., Dallas, Tex., plans a cotton mill to cost $750,000. The Hidalgo Utilities Company, Hidalgo, Tex., plans an ice plant to cost $50,000. The Texas Utilities Company plans a 60-ton ice plant at Mineral Wells, Tex. Muskogee, Okla., plans an ornamental lighting system to cost $50,000.

Activities of the Trade

Stone & Webster Open Office in Paris

Stone & Webster, Inc., Boston, announces the opening of a Paris (France) office at 2 Rue des Italieñs, in charge of James F. Case, whose engineering and financial career has covered many parts of the Orient and North and South America. In announcing this new office Stone & Webster point out that this step reflects the rapid growth in American financing and enterprises abroad and the increased activity indicated by this country's loans to foreign governments. Among the recent foreign projects upon which the Stone & Wester organization has reported are the Adriatic Electric Company, Lombard Electric Company and the Italian Public Utility Credit Institute.

American Electric Motor Part of Splitdorf-Bethlehem

The American Electric Motor Company, Cedarburg, Wis., has become a subsidiary of the Splitdorf-Bethlehem Electrical Company, Newark, N. J. In addition to the American Electric Motor Company the Splitdorf company controls the Splitdorf Radio Corporation, the Splitdorf Company of Canada, the Splitdorf Electrical Company, the Splitdorf Manufacturing Company and the Perfection Appliance Company. The American Electric Motor Company, in its new plant at Cedarburg, will continue to manufacture a self-ventilated polyphase induction motor from ½ hp. to 125 hp. supplied with standard sleeve bearings or ball bearings. W. R. Davis has been appointed general manager of the American company and W. M. Sprinkman will have charge of industrial sales.

General Electric Company Rewards Employees

Twenty-six awards were made to General Electric employees by the Charles A. Coffin Foundation for achievements during the year 1927. Announcement of the names of the winners and the formal presentation of the honorarium of $300, the certificate of award and the lapel button were made recently. The awards were divided as follows: Workmen, seven; tool designers and expert mechanics, three; foremen, five; construction foremen, one; engineers, six, and commercial employees four.

THE UNION METAL MANUFACTURING COMPANY, Canton, Ohio, through its representative the Southwest General Electric Supply Company, has received an order from Houston, Tex., for 96 twin-light pressed-steel lamp standards, which will be installed on Main Street. Houston will be host to the National Democratic convention this year. The standards will be installed prior to the opening of the convention in June. The company has also received an order from Houston for 21 traffic standards. These standards are of the same general appearance and design as the lighting standards and will carry a side bracket type signal.

THE WOLCOTT MANUFACTURING COMPANY, 80 Pliny Street, Hartford, Conn., and the Beardsley Manufacturing Company, Waterbury, Conn., will be consolidated as the Beardsley & Wolcott Manufacturing Company. Both companies manufacture a line of household appliances. The new officers are: C. E. Beardsley, president-treasurer; Frank E. Wolcott, vice-president; Rowley W. Phillips, secretary; Elton S. Wayland, Henry W. Adams, Jr., George T. Wigmore, Irvin W. Day and William S. Fulton, directors and officers.

THE STYLOGRAPH COMPANY, Rochester, N. Y., announces that its wax sensitized charts used on different types of recording instruments are now available for general purchase. The manufacturer claims that the use of Stylograph charts instead of pen and ink charts permits the installation of permanent points on the graphic instrument and no attention is required throughout the life of the instrument.

THE ALLIS-CHALMERS MANUFACTURING COMPANY, Milwaukee, has appointed R. T. Stafford, for years manager in Seattle, Wash., of the Northwest branch of the company, as assistant manager of the electrical department of the Pittsburgh Transformer division of the company at Pittsburgh, Pa. Mr. Stafford will be succeeded as Northwest branch manager by John Alberts, who has been identified with the Allis-Chalmers company for the past sixteen years.

THE GENERAL ELECTRIC COMPANY, merchandise department, announces a reduction in the price of its vacuum cleaner. This cleaner, which formerly sold, complete with attachments, for $49, will now be sold without attachments for $35, the present attachments being sold separately for $10. A special set of attachments also will be sold for $6.50.

THE TAFEL ELECTRIC COMPANY, Louisville, Ky., announces that a fire which gutted the building next to its Louisville house on Feb. 13 only caused damage by water to a portion of its stock of about $40,000 worth of merchandise in its basement. The company states that the majority of its stock on the other four floors of the building was not damaged and owing to prompt shipments of manufacturers and co-operation of local competitors only a half dozen shipments were delayed over 24 hours.

THE LOUIS ALLIS COMPANY, Milwaukee, manufacturer of direct and alternating-current motors, announces the opening of a district sales office in Cleveland. W. F. Glaser has been appointed district sales manager with headquarters at Room 409, Union Building, 1836 Euclid Avenue.

New Equipment Available

Fuse and Disconnect Cutout

The Kearney double-duty fuse and disconnect cutout in fuse capacities from 1 amp. to 200 amp. and made of plastic wet process porcelain has been developed by the James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis. The cartridge contacts make direct contact with the machined surfaces of the copper castings to which the line wires are fastened. The contacts are made of spring phosphor bronze. Each line terminal is equipped with two extra heavy screws to eliminate the possibility of the line wire working loose in the terminal block. By interchanging the cartridge with a disconnect blade the unit can be used as a disconnect with a range of capacities from 75 amp. to 300 amp.

METHOD OF MOUNTING KEARNEY DOUBLE-DUTY FUSE AND DISCONNECT CUTOUT

Spring Clutch

The L. G. S. spring clutch, having only three working parts, the driving member, the driven member and the connecting link, has been placed on the market by the L. G. S. Manufacturing Company, Indianapolis, Ind. Operating within the recesses of the driving and driven members the smooth-surfaced spring-connecting link expands and contracts under friction according to the direction in which the mechanism is turning. Thus a right-hand turn makes a positive connection and the driven member revolves, while a left-hand turn releases the pressure and the driving member runs free.

The clutch is made in three general types. In the ratchet type the clutch may be freely rotated in one direction, but automatically engages when rotated in the opposite direction. With the manual type the clutch is thrown in and out by the operator. In the centrifugal type the clutch is automatically thrown in and out at certain speeds as may be required by the machine to which it is attached. Some of the applications referred to by the manufacturer are as an unloading clutch for electric motors, pumps, air compressors, refrigerating machines, etc.; as a clutch for machine countershafts, washing machines, change feed devices, etc.; as an overrunning clutch for separators, feeding devices, punch presses, etc.; as a reverse mechanism for washing machines, tapping machines, etc., and as a ratchet wrench or for other ratchet tools.

Line-Start Induction Motors

A line of squirrel-cage induction motors suitable for starting on full-line voltage is being placed on the market by the Allis-Chalmers Manufacturing Company, Milwaukee. These motors are normal-torque, high-reactance machines and will not draw starting currents in excess of limits recommended by the electrical apparatus committee of the National Electric Light Association. They are built in ratings from 7½ hp. to 30 hp., 600 to 3,600 r.p.m., low voltage, and are available with either sleeve or roller bearings. The company states that all the features of Allis-Chalmers construction employed in squirrel-cage motors are maintained in this new line.

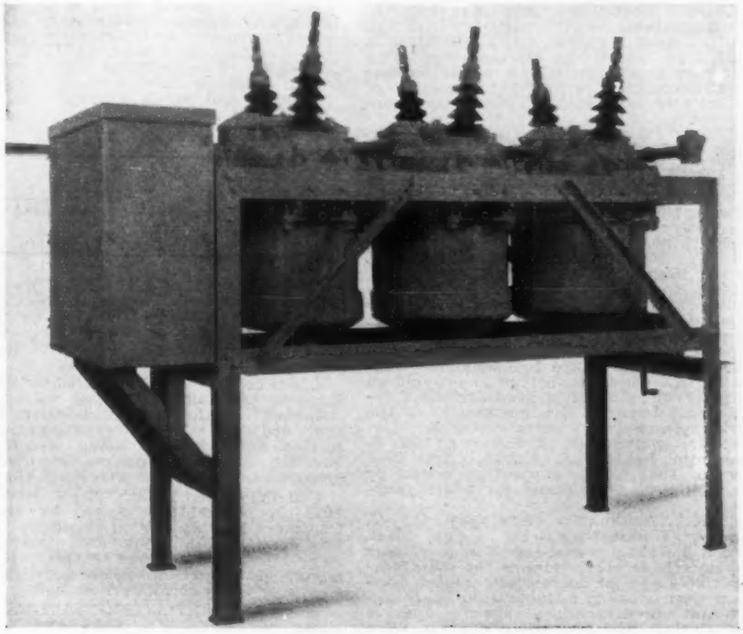
Subway Sectionalizing Unit

A new type of subway sectionalizing unit for branching underground distribution lines has been placed on the market by the Metropolitan Device Corporation, 1250 Atlantic Avenue, Brooklyn. By its use it is possible to branch main feeders, connect transformers to a low-tension network, connect sub-feeder taps, tie lines and service and to sectionalize safely any section for any reason. The manufacturer states that these units provide a safe, convenient and economical method of branching underground distribution lines and that many combinations and groupings are possible. The units are available in two types, one rated at 250 volts, 500 amp., and the other at 250 volts, 1,500 amp.

25-Kv. Circuit Breaker

A high-tension outdoor-type oil circuit breaker for 25-kv. service, known as the type FO-40-25, has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston. The design is based on that of the company's type FO-40 for 37-kv. service and above. The new breakers are furnished for 2,000 amp. or less at 25 kv. and the maximum estimated interrupting capacity is 1,500,000 kva. These breakers may be manually or electrically operated by either alternating or direct-current control, and automatic reclosing service of one or more closing cycles with constant or varying time delay may be added.

The units are mounted on a channel and angle-iron framework, and large porcelain type solid bushings of high mechanical strength extending below the oil line and securely clamped to the pole top with watertight gaskets provide insulation in excess of the A. I. E. E. voltage test requirements. The tanks are cylindrical with rounded bottoms and are built of welded steel plate. The pole top castings are of massive design and are heavily ribbed with a deep extending flange surrounding the tanks to facilitate withstanding gas pressures or secondary explosions incident to rupturing high-powered circuits. Condit laminated brushes are furnished, protected on closing and opening by arcing contacts arranged to provide four breaks in series.



OUTDOOR-TYPE OIL CIRCUIT BREAKERS FOR 25-KV. SERVICE

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 14, 1928)

1,658,832. SAFETY ELECTRIC COUPLER; L. A. Brown, Uniontown, Pa. App. filed Jan. 5, 1926. For connecting shot firing cables used in mines to a magneto or other source of current.

1,658,848. THEFT ALARM; S. M. Kalikow, Brooklyn, N. Y. App. filed Feb. 8, 1926.

1,658,861, 1,658,862. ELECTRICAL OUTLET DEVICE; H. E. Slade, Glen Ridge, N. J. Apps. filed Dec. 11, 1926.

1,658,872. ELECTROLYTIC APPARATUS; H. J. Yeager, Lancaster, Pa. App. filed Jan. 16, 1925. For use in the electrolytic deposition of metals.

1,658,884. ELECTRIC KNIFE; M. Cysick, Cotton, Minn. App. filed Feb. 7, 1927. Which can be used most efficiently for cutting warm or hot bread, which if cut by a cold knife will be made heavy.

1,658,887. DUCT GRAPPLE; J. F. Dotzauer, Newark, N. J. App. filed Jan. 22, 1926. Used in connection with the placing of cables in underground ducts or conduits.

1,658,900. TIME-CONTROLLED SWITCH; S. Jimenez, San Antonio, Texas. App. filed Sept. 10, 1925.

1,658,902. ELECTRICAL MEASURING INSTRUMENT; R. T. Pierce, East Pittsburgh, Pa. App. filed March 24, 1924. Of the indicating or deflecting type.

1,658,905. FUSE MECHANISM; M. J. Sandin, Wilkinson, Pa. App. filed Jan. 23, 1923. Inclosed expulsion-fuse mechanism for outdoor installations.

1,658,906. PHASE BALANCING SYSTEM; J. Slepian, Swissvale, Pa. App. filed June 10, 1922. Employing single-phase synchronous condensers for effecting a phase balance.

1,658,912. ELECTRIC CIRCUIT BREAKER; F. W. Alder, Oakland, and S. N. Baruch, Palo Alto, Cal. App. filed Feb. 24, 1920. Automatic circuit breaker in which all of the separable contacts are submerged in oil.

1,658,913. SWITCH MECHANISM; H. K. Ansingh, Toronto, Can. App. filed Feb. 20, 1923. Circuit breakers of the safety type wherein the circuit breakers and disconnecting switches are inclosed within a metal housing.

1,658,914. SALT FOR ELECTROLYTIC RECTIFIERS; F. W. Barhoff, Hartford, and W. C. Brooks, Meriden, Conn. App. filed May 26, 1927. A dry salt, needing only the addition of water to form a complete electrolyte for current rectifiers and electrolytic condensers having tantalum or similar filming metal electrodes, which salt is chiefly composed of ammonium bisulphate.

1,658,918. MOTOR CONTROL SYSTEM; R. Brooks, Ashton-on-Mersey, and E. H. Croft, Leeds, England. App. filed Jan. 8, 1923. In which the acceleration of a motor by short-circuiting a series resistor is automatically effected by means of electrically actuated switches or contactors.

1,658,926. SELECTIVE OVERLOAD TRIP RELAY; F. B. Kniskern, Wilkinsburg, Pa. App. filed Sept. 23, 1924.

1,658,945. BUS-LINE CONNECTER; S. B. Schenck, Wilkinsburg, Pa. App. filed June 5, 1922. A device for connecting up the power line between cars in an electrical railway train.

1,658,948. PHASE BALANCING SYSTEM; J. Slepian, Swissvale, Pa. App. field June 10, 1922. Employing single-phase synchronous condensers for effecting a phase balance. A system wherein the respective single-phase components of the delta voltages across three line conductors of a polyphase system are independently regulated in such a manner as to provide an equality or any other predetermined relationship between the magnitudes of the various single-phase delta voltages.

1,658,953. SIGNALING APPARATUS; L. S. Theremin, Leningrad, Russia. App. filed Dec. 5, 1925. For generating sound or producing visual signals for alarm purposes.

1,658,972. REGULATOR SYSTEM; O. C. Cordes, Wilkinsburg, Pa. App. filed March 2, 1926. Speed-regulating systems for electric motors. Means for maintaining the speed of an electric motor constant that is easily adjustable to maintain different predetermined speeds and is sensitive in its operation over a wide speed range.

1,658,980. PHASE BALANCING SYSTEM; C. Le.G. Fortescue, Pittsburgh, Pa. App. field June 23, 1925. Systems of this character as employ single-phase synchronous condensers for effecting a phase balance. A system wherein two single-phase reactance devices may be utilized to balance the voltage and current in a three-phase or four-phase system or, in general, in any polyphase system.

1,658,983. SIGNAL WIRE HANGER; A. J. Gurney, Canton, Ohio. App. filed Nov. 7, 1923.

1,658,990. ELECTRIC HEATING UNIT; A. D. Keene, Pittsburgh, Pa. App. filed March 26, 1925. Embedded electric heating unit.

1,659,013. SPOT LAMP; E. G. K. Anderson, Evanston, Ill. App. filed Oct. 25, 1924.

1,659,027, 1,659,028. CLOCK; F. C. Holtz, Springfield, Ill. Apps. filed Nov. 15, 1924. With a low power electric motor drive.

1,659,050. STORAGE BATTERY CHARGING APPARATUS; R. J. Sasseman, Chicago, Ill. App. filed Jan. 30, 1925. For charging the storage batteries of radio receiving apparatus, or for similar purposes.

1,659,058. THERMOSTATIC SWITCH; R. R. Stitt and C. F. Warrick, Detroit, Mich. App. filed May 1, 1924.

1,659,059. ADJUSTABLE RESISTANCE UNIT; C. E. Stryker, North Chicago, Ill. App. filed Oct. 21, 1925. As used in railway battery and signal circuits.

1,659,062. COIL MOUNTING; R. Varley, Englewood, N. J. App. field Nov. 15, 1926. Adapter for the mounting of small coils such as are used in the smaller type of transformers.

1,659,071. SIGN FLASHER; E. W. Applebaum, Chicago, Ill. App. filed May 27, 1926. For alternating current service.

1,659,091. PORTABLE OVEN; R. P. Fabbrini, Chicago, Ill. App. filed May 12, 1926.

1,659,094. CONDUIT ATTACHING TO OUTLET BOXES; F. A. Godfrey, Chicago, Ill. App. filed Oct. 21, 1925.

1,659,102. ELECTRIC WATER HEATER; G. Harvis, Detroit, Mich. App. filed Sept. 24, 1925. Portable type.

1,659,106. DYNAMO ELECTRIC MACHINE; F. Hillebrand, Niederschonhausen, Berlin, Germany. App. filed Aug. 22, 1927. Of the split-pole commutator type and has for its object the provision of a self-excited generator of this character in which the voltage may be adjusted over a range from substantially zero to the full voltage of the machine, and in which the terminal voltage for any given adjustment will remain substantially constant.

1,659,110. CONTINUOUS CURRENT TRANSFORMER; T. C. Lennox, Pittsfield, Mass. App. filed Aug. 20, 1925.

1,659,134. AUTOMATIC ELECTRIC WATER HEATER; M. C. Crawley, Groton, N. Y. App. filed Feb. 26, 1924.

1,659,160. LIGHT EXTENSION; A. Richards, Mexico, Me. App. filed June 4, 1924.

1,659,183. INSULATOR; A. O. Austin, Barberton, Ohio. App. filed Oct. 20, 1921. For high tension use.

1,659,208. SELF WINDING CLOCK AND THE LIKE; S. Manheim, Bridgeport, Conn. App. filed Dec. 19, 1925.

1,659,256. CLOCK; M. A. Gerson, Jersey City, N. J. App. filed July 20, 1926. Self-winding electrical clock.

1,659,267. PANEL CABINET FOR ELECTRICAL CONNECTIONS; J. W. Hooley, Larchmont, N. Y. App. filed Sept. 20, 1926.

1,659,278. COMBINATION RADIANT HEATER AND CURLING IRON ATTACHMENT; H. E. Meltzer and M. J. Svoren, Racine, Wis. App. filed Aug. 9, 1926.

New Trade Literature

WIRES AND CABLES. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-905 covering its insulated wires and cables, including data on current-carrying capacities of its paper-insulated, lead-covered cables.

LIGHTNING ARRESTERS.—"Discharge Rate of Lightning Arresters vs. Protection Afforded" is the title of booklet No. 247, the third of a series covering lightning protection and which is being issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 1118-E issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates its type "AR" squirrel-cage and type "ARY" slip ring poyphase induction motors, with either sleeve or tapered roller bearings.

MOTORS AND GENERATORS. — Bulletins No. 6023, No. 6022 and No. 6025 issued by Engberg's Electric & Mechanical Works, St. Joseph, Mich., describe and illustrate the Engberg constant and adjustable speed, ball bearing, direct-current motors; the type M ball bearing bracket type direct-current generators and motor-generators. Dimension tables are also included in the bulletins.

BEARINGS AND PILLOW BLOCKS.—The Rollway Bearing Company, Inc., Syracuse, N. Y., has issued catalog No. 4-A covering its wide series and utility types of bearings. The company is also distributing bulletins Nos. 53, 54, 55 and 56 covering respectively the self-aligning pillow blocks equipped with Rollway adapter type bearings to fit standard commercial shafting, various precision types of Rollway radial bearings, self-aligning pillow blocks equipped with standard bearings and large Rollway bearings in the recently adopted international sizes.

PLIERS.—A pamphlet issued by the Utility Equipment Company, 1035 East 76th Street, Chicago, covers its high-voltage pliers.

OIL CIRCUIT BREAKERS. — Bulletin GEA-925 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its types FK, FKO, FHK and FHKO-139 station oil circuit breakers for 7,500 to 220,000 volts and 600- to 2,000-amp. service. Bulletin GEA-926 gives the dimensions of these station oil circuit breakers.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Rome, Italy (No. 29,754), for electrical bakery ovens, etc.

An agency is desired in Alexandria, Egypt (No. 29,858), for electric bulbs, fuse boxes, switches and insulated and bare copper wire.

An agency is desired in Berlin, Germany (No. 29,774), for electric dental and medical apparatus.

An agency is desired in Arnhem, Netherlands (No. 29,761), for household electrical appliances.

An agency is desired in Cochabamba, Bolivia (No. 29,840), for household electrical appliances and wiring supplies.

An agency is desired in London, England (No. 29,861), for household labor-saving devices.

Purchase and agency are desired in São Paulo, Brazil (No. 29,871), for farm-lighting sets.

Purchase is desired in Pizen, Czechoslovakia (No. 29,854), of electric planes.

Purchase and agency are desired in Osaka, Japan (No. 29,756), for electric railway equipment.

An agency is desired in Vienna, Austria (No. 29,860), for electric household refrigerators.

Purchase and agency are desired in Magdeburg, Germany (No. 29,856), for electric washing machines.

Purchase is desired in Erfurt, Germany (No. 29,857), of electric washing machines.

Purchase is desired in Magdeburg, Germany (No. 29,855), of electric washing and wringing machines.

The General Engineering Company, 13 Union Bank Building, Apollo Street, Fort Bombay, India, desires to purchase transformers and auxiliary equipment, house service meters and line materials. This company wishes a list of prices and other information in duplicate. A copy of the specifications for this material is available for loan to interested American firms and may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., reference EE 1064.

Carrick Wedderspoon & Company, New Zealand, wishes to get in touch with American manufacturers of electrical equipment with a view to securing agencies. The company is interested in electric ranges, 230 volts; vacuum cleaners; time clocks, 40 days winding, used mostly for hot water heaters, single pole, single throw; electric refrigerators, 230 volts, 50 cycles; electric washing machines, electric sewing motors, domestic heating and cooking devices, electric ironing and washing machines, as well as battery-charging plants for garages. Further information may be obtained upon request to the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., reference EE 1065.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Two Homes Out of Three Electrified

WITH the rapid increase of the number of residential connections to electric power circuits the question has arisen in the electric light and power industry as to the effect of increasing saturation in this respect. It is probably equally pertinent in other lines, notably in the telephone and automobile industries, for by a coincidence the number of telephones, of automobiles and of electric light and power customers are roughly equal, all being in the general neighborhood of 20,000,000, although the distribution between private or residential users on the one hand and commercial or industrial users on the other probably differs.

The total number of electric light and power customers in the United States as of Jan. 1, 1928, was 21,694,100, of whom 17,596,400 were residential, according to figures published in the ELECTRICAL WORLD of Jan. 7, 1928.

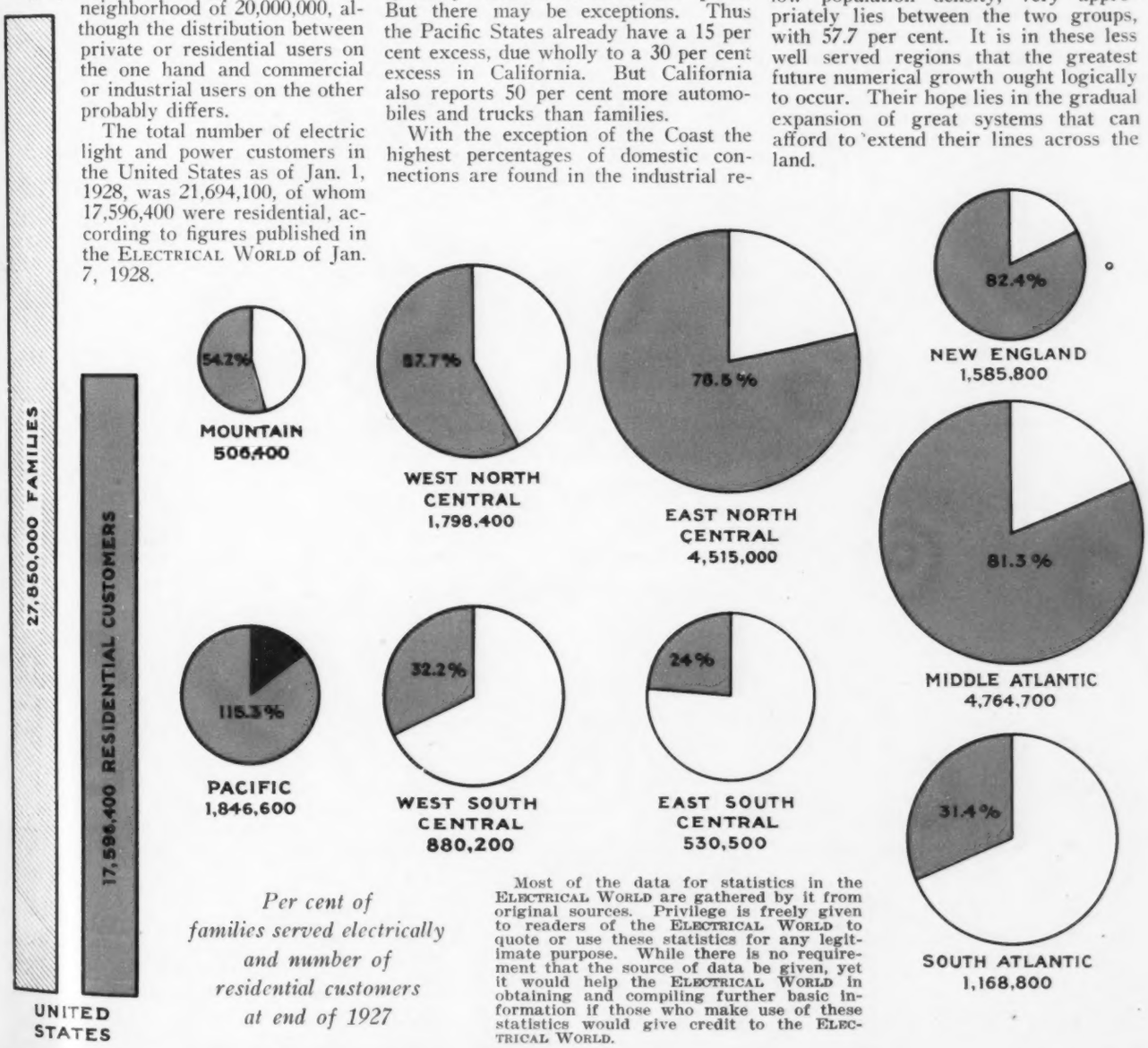
The number of families may be taken approximately at 27,850,000. The number of residential electric customers is thus about 63 per cent of the number of families. It has multiplied tenfold in twenty years.

What of the future? The assumption has been made that the number of residential customers is definitely limited by the number of families. That is probably true in general, and must be seriously considered in future plans. But there may be exceptions. Thus the Pacific States already have a 15 per cent excess, due wholly to a 30 per cent excess in California. But California also reports 50 per cent more automobiles and trucks than families.

With the exception of the Coast the highest percentages of domestic connections are found in the industrial regions; New England has 82.4 per cent; the middle Atlantic States, 81.3 per cent; the East North Central States, 78.5 per cent.

In regions predominantly rural, electrification is far more difficult and has proceeded more moderately. Thus the proportion of residential consumers to families is only 24.0 per cent in the East South Central States, 31.4 per cent in the South Atlantic States and 32.2 per cent in the West South Central States.

The West North Central region, with its mixture of manufacturing industries in large cities and of agriculture with its low population density, very appropriately lies between the two groups, with 57.7 per cent. It is in these less well served regions that the greatest future numerical growth ought logically to occur. Their hope lies in the gradual expansion of great systems that can afford to extend their lines across the land.



Per cent of families served electrically and number of residential customers at end of 1927

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Seasonal Increased Production in North Central States

THAT the manufacturing plants of the North Central States witnessed materially increased productive activity during January over those of December is indicated by reports on electrical energy consumption received by the ELECTRICAL WORLD from about 850 large manufacturing plants operating in this section. This increase in operations of about 7.8 per cent appears to be largely seasonal in nature, but is less than the increase recorded during January, 1925 and 1927, but greater than that recorded for January, 1924, and January, 1926. It might be said, therefore, that an average increase in productive operations was recorded during the current January.

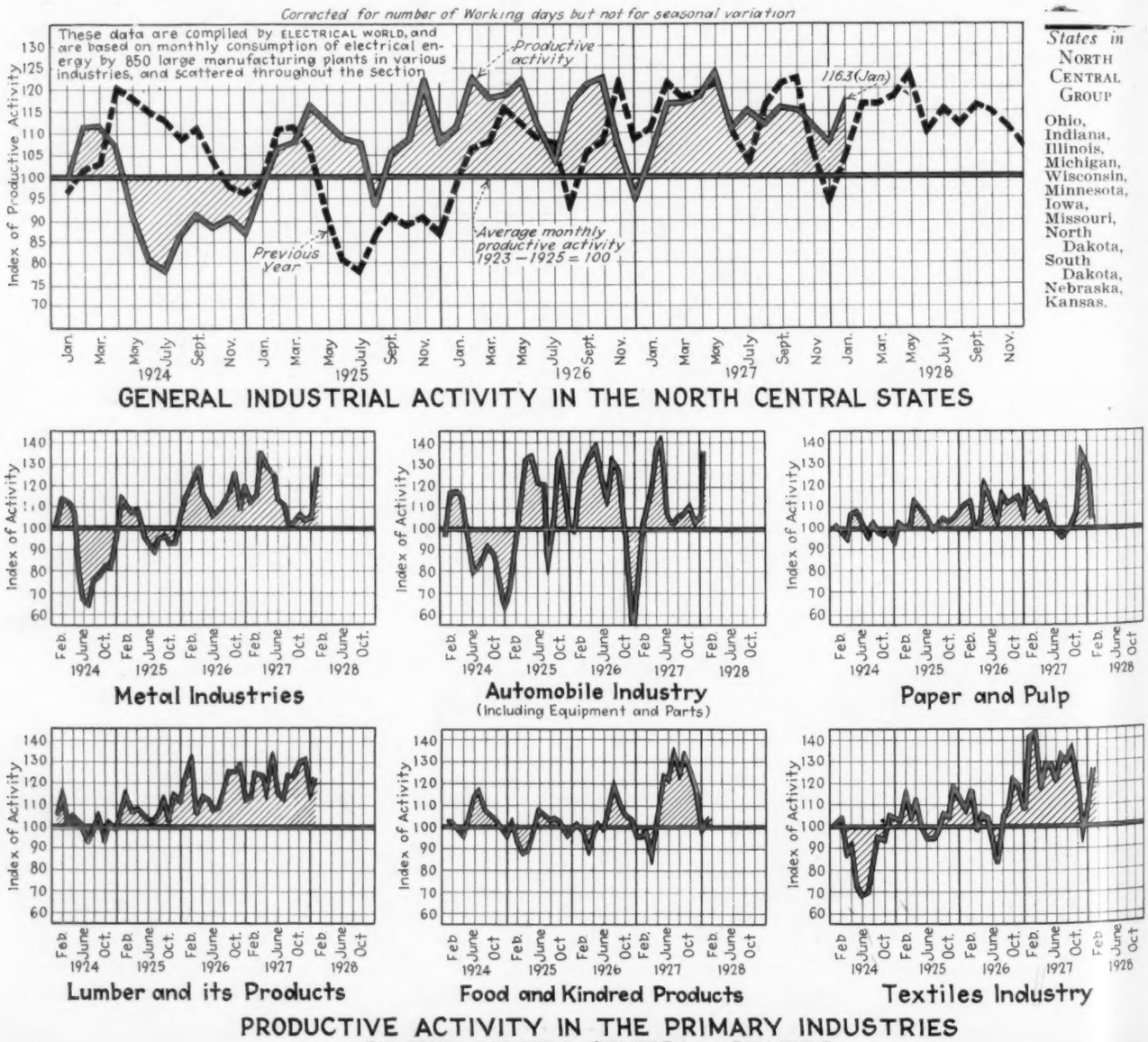
The increased operations of general industry during January was due very largely to the materially increased rate of activity recorded by the metal industries, the automobile manufacturing industry and the textile industry, the increased activity of these industrial groups more than offsetting the decreased operations in some of the other industrial groups. During January seven of the section's primary industrial groups—textiles, lumber and its products, automobiles, including the manufacture of equipment and parts; rolling mills and steel plants, metal working plants, food and kindred products, and leather and its products—witnessed productive activities materially over those reported for December, 1927.

Indexes of Productive Activity in the North Central States

All Figures Adjusted for Number of Working Days

	Jan., 1928	Dec., 1927	Jan., 1927	Average for Full Year, 1927	Average for Full Year, 1926
All industries	116.3	107.8	105.5	114.5	114.4
Chemical and allied products	82.3	99.4	92.3	100.5	112.8
Textiles	126.3	110.0	141.0	126.1	106.4
Lumber and its products	120.2	113.2	114.2	121.5	117.6
Paper and pulp	105.8	129.3	119.9	110.2	110.0
Automobiles, including parts and equipment	135.8	106.4	78.2	110.1	113.7
Metals group	128.7	104.3	112.0	113.2	116.2
Rolling mills and steel plants	132.8	113.3	116.6	118.1	118.6
Ferrous and non-ferrous metal working plants	124.6	95.2	.....	.....	.....
Food and kindred products	103.3	100.2	.....	.....	.....
Leather and its products	113.8	101.2	.....	.....	.....

ELECTRICAL WORLD *Barometer of Industrial Activity in the North Central States*


Corrected for number of Working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 850 large manufacturing plants in various industries, and scattered throughout the section
Productive activity
116.3 (Jan)
Previous Year
Average monthly productive activity 1923—1925 = 100
Index of Productive Activity
States in NORTH CENTRAL GROUP
Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.
GENERAL INDUSTRIAL ACTIVITY IN THE NORTH CENTRAL STATES
Index of Activity
Metal Industries
Automobile Industry
(Including Equipment and Parts)
Paper and Pulp
Lumber and its Products
Food and Kindred Products
Textiles Industry
PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NORTH CENTRAL STATES